A KALEIDOSCOPE OF LANGUAGES:
UNDERSTANDING THE DYNAMICS OF LANGUAGE USE AND ITS EFFECTS ON DAILY COMMUNICATION IN MULTILINGUAL TEAMS

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A KALEIDOSCOPE OF LANGUAGES:

UNDERSTANDING THE DYNAMICS OF LANGUAGE USE AND ITS EFFECT ON DAILY COMMUNICATION IN MULTILINGUAL TEAMS

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Multilingual teams in which people speaking different native languages work together are increasingly common in modern organizations. Previous research suggests that multilingual teams have the potential to incorporate information and human resource at a global scale. This potential, however, is hard to fulfill when language related issues, such as a lack of fluency in a team's common language or clustering in native language based subgroups, impede team members from communicating efficiently. To date, there is little empirical knowledge of how members of multilingual teams handle these communication issues through their daily practice of language use.

In this dissertation, I examined the dynamics of language use and its effects on daily communication in multilingual teams through an in-depth field study guided by grounded theory. Six multilingual teams participated in this study. All these teams used English as their only common language at work. I conducted over 100 hours of observation with each team and collected three types of data regarding people's language use during daily communication events: text-based observation notes that documented the contextual information of each communication event and people's language use behavior during the event; audio-recorded retrospection that

reported people's interpretations of everybody's language use behavior during the event; and images donated by participants that captured how people used various tools and materials to facilitate communication when needed.

Through multiple iterations of coding, I identified several patterns of language use that tell 1) *when* and *why* members of multilingual teams used English rather than their native language, and vice versa, at work, and 2) *how* they incorporated various strategies, if any, into the practice of using either English or their native language such that they could maximize the values and minimize the costs of their language choice.

Based on these findings, I discuss how the current research added to previous knowledge on multilingual teamwork, language choice and conversational grounding. Future research directions and design implications deriving from these findings are also outlined at the end of this dissertation.

BIOGRAPHICAL SKETCH

Ge Gao conducted her PhD study in the Department of Communication at Cornell University, with a minor in Information Science. She worked in the Intercultural Communication Lab led by Prof. Susan R. Fussell. Prior to Cornell, she received double Bachelors' Degrees in Psychology and Philosophy and a Master's Degree in Social Psychology from Peking University in China. She also worked as a research assistant in the HCI group at Microsoft Research Asia and NTT Communication Science Laboratories in Japan.

致我的父親，

感謝您教給我對於世界的好奇，探索和愛。

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LIST OF ABBREVIATIONS

CMC	Computer-mediated communication
CSCW	Computer-supported cooperative work
IM	Instant messaging
MNC	Multinational corporation(s)
MT	Machine translation
NNS	Non-native speaker(s)
NS	Native speaker(s)

CHAPTER 1

INTRODUCTION

Multilingual teams in which people speaking different native languages work together are common in modern organizations. Despite the promise of multilingual teams for integrating diverse resources at a global scale, this potential is often hindered by language related challenges (Feely & Harzing, 2002).

Previous studies with multinational corporations (MNC) have pointed out that members of multilingual teams may choose between English and their native language to conduct a conversation at work. Either choice can lead to both positive and negative consequences. For instance, speaking a common language allows everyone to participate in the conversation regardless of their native language (Henderson, 2005); however, the efficiency of communication between native speakers (NS) and non-native speakers (NNS) of the common language may be unsatisfactory and non-native speakers may avoid speaking up due to various concerns (e.g., Barner-Rasmussen & Björkman, 2007; Marschan-Piekkari, 2006; Neeley, 2013; Rogerson-Revell, 2008; Tange & Lauring, 2009). Shifting to one's native language enables everyone to speak most naturally and fluidly (e.g., Ehrenreich, 2010), but it often hinders the exchange of information at the team level and clusters people into language based subgroups (e.g., Barner-Rasmussen & Aarnio, 2011; Hinds et al., 2014; Lønsmann, 2014). For best structuring team conversations, it is important to understand what factors may motivate team members to choose one specific language over others and how they can handle the potential negative consequences of each language choice. Current MNC research, unfortunately, provides very limited knowledge regarding these two questions.

Besides research with MNC, studies in other fields also propose concepts and findings that help provide a more complete understanding of language use during teamwork. For example, scholars studying bilingual conversations have pointed out that bilingual speakers often make intentional switches between languages to achieve specific social needs (e.g., Fishman, 1965; Myers-Scotton, 1980) and/or discourse purposes (e.g., Auer, 2013; Gafaranga, 2000). Literature on conversational grounding further suggests that interlocutors speaking different native languages can collaboratively figure out the intended meaning of each other's messages when using a common language to communicate (e.g., Clark, 1996; Gass & Varonis, 1985). However, since these two groups of studies are mostly conducted outside the setting of teams, it is unclear how they can be connected with previous MNC literature and generate a coherent story of language use in multilingual teams.

My current research extends previous literature by examining people's motivations for choosing their native language vs. a common language, consequences of the language choice and how people handle those consequences in their following language use within a unified context of multilingual teamwork. Two general questions guided this research:

1) *When* and *why* do members of multilingual teams use English rather than their native language, and vice versa, at work?

2) *How* do members of multilingual teams incorporate various strategies, if any, into the practice of using either English or their native language such that they can maximize the values and minimize the costs of their language choice?

To address these research questions, I examined the dynamics of language use and its effects on daily communication in six multilingual teams through an in-depth field study guided by grounded theory. I conducted over 100 hours of observation with each team and collected

three types of data regarding people's language use during daily communication events: text-based observation notes that documented the contextual information of each communication event and people's language use behavior during the event; audio-recorded retrospection that reported people's interpretations of everybody's language use behavior during the event; and images donated by participants that captured how people used various tools and materials to facilitate communication when needed.

Through multiple iterations of coding, I identified several patterns of language use. First, NNS in multilingual teams often shifted back and forth between using English and using their native language based on their situational needs. They developed context-based strategies, such as using certain discourse markers and exploring affordances of the communication medium, to balance positive and negative consequences of their moment-to-moment language choice. Second, team members, when having to use English as a common language to communicate, relied on three types of co-presence as suggested by Clark (1996) to resolve grounding problems. They also took advantage of materials, human resources and technologies embedded in the contextual environment to ensure their co-presence. Third, the language practice of individual members affected how information sharing and interpersonal dynamics was structured at the team level. People speaking different native languages worked collaboratively to fulfill the team's potential of incorporating information across language boundaries.

The rest of this dissertation is organized as follows: Chapter 2 reviews previous studies that provide potential insight into language use in multilingual teams. Building upon a reflection of these studies, I introduce the rationale for my study and the development of my research questions. Chapter 3 describes my research method, including my sampling strategies, data collection process and data analysis guided by the grounded theory (Corbin & Strauss, 1990).

Chapter 4 presents three groups of findings that describe the dynamics of language use in multilingual teams. Finally, Chapter 5 discusses how findings from my research can contribute to our understanding of language use in multilingual teams and the design of future communication tools.

CHAPTER 2

BACKGROUND

When people speaking different native languages work together in teams, they can choose between the common language (e.g., English) and each team member's native languages to conduct a conversation. Either choice avoids certain difficulties people may encounter during team collaboration but creates others. A systematic understanding of language use in multilingual teams requires researchers to examine at least three interrelated issues: 1) motivations that drive people to choose one specific language over others; 2) consequences of this language choice; and 3) strategies people develop to handle those consequences. Although each issue has been examined by earlier scholars, misalignments in research settings and methods between studies make it difficult to tell a complete story based on previous findings. For example, research with multinational corporations has provided rich *in-situ* evidence demonstrating that speaking a required common language often impedes efficient communication with NNS employees (e.g., Neeley, 2013; Tange & Lauring, 2009); but it spends little effort examining how people solve those communication problems through practices of language use. In contrast, psycholinguistics has proposed concepts and theories that indicate how NS and NNS interlocutors can establish conversational grounding using a common language (e.g., Clark, 1996; Varonis & Gass, 1985); this research, however, mostly examines language use in lab settings rather than during multilingual teamwork in the field.

The current chapter reviews empirical evidence from previous studies that provide potential insight into language use in multilingual teams. I start by introducing MNC research that describes challenges of conducting work communication in a common language and in each member's native language. After that, I present two lines of work that look into two specific

aspects of multilingual communication in general situations. One line of work identifies factors that influence people's language choice during multilingual conversations. The other looks at how people use a common language to ground intended meanings and overcome challenges. Findings, concepts and theories provided by all these areas of previous research lay a foundation for my current study, which aims at understanding the dynamics of language in actual multilingual teamwork. Building upon a reflection on the limitations of previous research, I present the rationale and research questions of my current research at the end of this chapter.

Language Related Challenges Faced by Multingual Teams

Language use in multingual teams is full of fluidity and complexity. Drawing on previous research with MNCs, the current section first discusses the experiences of NNS team members and how they tend to behave when they are required to use a second language to communicate at work. This research indicates that using a common language not only leads to challenges faced by NNS but also influences the way team members interact with each other. Further, a series of recent studies has suggested that NNS members in multilingual teams usually do not stick with one single type of language to conduct all of their work conversations (e.g., Barner-Rasmussen & Aarnio, 2011; Beyene et al., 2009). The second part of this section, therefore, reviews previous research that concerns the use of multiple languages during teamwork.

The required use of a common language as the working language

Multilingual teams often require their members to use a common language, such as English, to conduct all work-related conversations (Henderson, 2005). Speaking a common language allows everyone to participate in work discussions regardless of their native language; however, it often puts a heavy burden on NNS team members (Beyene et al., 2009). Dating back to the 1970s, scholars have found that NNS employees need to put in more effort than their NS

colleagues when preparing presentations and written materials in the required working language (Hilderbrandt, 1973). Recent studies further point out that NNS employees often perceive themselves as having lower language competence than NS colleagues (e.g., Aichhorn & Puck, 2017), believe that they lack the ability to conduct social conversations in their second language (e.g., Henderson, 2005), feel devalued and insecure in the workplace (e.g., Beyene et al., 2009; Neeley, 2013), and are less satisfied about their career outcomes due to their limited language ability (e.g., Russo et al., 2017).

To help alleviate the burden that using a common language places on NNS team members, both NS and NNS often accommodate the way they speak to their colleagues (Aichhorn & Puck, 2017). Research has found that over time multilingual organizations may develop a form of "company speak" that contains simplified expressions and jargon that are not part of the standard common language (e.g., Bartlett & Johnson, 1998; Cohen & Kassis-Henderson, 2017; Welch et al., 2005). With this accommodation, however, NNS may still find it difficult to conduct stilted conversations in the common language (Beyene et al., 2009). They sometimes choose to avoid rather than spend effort holding those conversations (e.g., Harzing & Feely, 2008; Lauring & Klitmøller, 2015; Marschan-Piekkari et al., 1997; 1999; Tange & Lauring, 2009).

Using a common language not only shapes the experiences of NNS in the workplace and influences how they behave, it also has a subtle influence on how people speaking different native languages interact at the team level. Previous research in this space indicates three aspects of team process that are associated with language use: positive vs. negative interaction, central vs. peripheral role assignment, and value vs. devalue judgment.

The first aspect of team interaction concerns the *positive vs. negative* interaction between NS and NNS members working on the same team. It shows that the difficulty of communication in a shared language often leads to negative stereotyping of the conversational partner (Aichhorn & Puck, 2017), a lack of shared vision and trust between team members (Barner-Rasmussen & Bjorkman, 2005), low interpersonal attraction (Henderson, 2005), and language based exclusions (Dotan et al., 2004).

The second aspect of team interaction considers the *central vs. peripheral* roles assigned to team members. A number of previous studies have found that individuals with higher fluency in the common language are usually positioned to the center of the communication flow. For example, Fredriksson and colleagues (2006) interviewed 36 employees working in the Finland site of a German company. Interviewees reported that Finnish employees who were good at the company's working language became the hub of both information exchange and social interaction across sites. Similarly, Marschan-Piekkari and colleagues (1999) conducted field research with off-shore employees of an English-speaking company. They found that bilingual speakers of English and a local language often gained access to more informational and social resources than their monolingual colleagues who were only fluent in the local language. Even when these bilingual speakers held low positions in the company hierarchy or lacked technical knowledge, they were able to take on important roles during team interactions.

Further, using a common language may active *value vs. devalue* judgment among team members. According to research conducted by Marschan-Piekkari (2005; 2006) and Lønsmann (2014), there is a belief among employees that the official working language is more proper, international and prestigious than other languages spoken in the organization. Therefore, having good skills in this more powerful language may boost one's career in implicit ways. Vaara and

colleagues (2005) also find that a person's fluency in the dominant common language was closely associated with the position s/he occupied within the power network of the team. People who comes from a more dominant speech community (e.g., an American employee working at an English-speaking company) were often perceived by management as being more valuable to the team (Tenzer et al., 2014).

The multilingual reality of multilingual teamwork

Having a required working language does not necessarily turn all work conversations into monolingual events (Angouri, 2013). During real work practice, people may interact in their own native languages instead of the working language (e.g., Aichhorn & Puck, 2017; Barner-Rasmussen & Aarnio, 2011; Beyene et al., 2009; Cohen & Kassis-Henderson, 2017; Kulkarni, 2015). Structuring team conversations in multiple native languages can have an influence on both information sharing and subgroup dynamics among team members.

Specifically, when members of the same team or organization communicate using their native languages, more frequent information sharing may happen between people from the same speech community rather than between people speaking different native languages. In a qualitative study with German and American employees of the same global company, Beyene and colleagues (2009) found that German employees sometimes initiated German conversations among themselves at English meetings. People reported that speaking German allowed them to better participate in the meeting rather than getting held back by their unsatisfactory fluency in English. However, this language choice excluded American employees from information sharing and made them feel lost and isolated. Tange and Lauring (2009) documented cases where different native languages were used not only at formal meetings but also during informal conversations. They interviewed both local and international employees at 14 Danish subunits of

several MNCs. Interviewees pointed out that although their companies all use English as the required working language, casual chat in the workplace was always in Danish. International employees, therefore, often missed important information exchanged through informal venues. Sorensen (2005) further pointed out the influence of using different native languages in written rather than verbal communication. He surveyed employees of 70 different corporations in Denmark. Respondents reported that work related documents were often generated in the respective local language at each subunit of the corporation. People used English as a common language to share information only when necessary.

Along with the native language based information sharing comes social clustering (Tange & Lauring, 2009). Members of multilingual teams often communicate in their native languages with other speakers of the same native language (e.g., Angouri, 2013; Barner-Rasmussen & Aarnio, 2011; Tange & Lauring, 2009). This behavior reinforces the social bonding within each language subgroup, which is explained by self-categorization theory (McGarty & Turner, 1992; Turner, 1991) and social identity theory (Tajfel & Turner, 1979; 1986). When there is a salient need to follow the required language policy, NNS may intentionally avoid using their native languages and speak the common language instead. However, they often move away from using the common language as the interaction continues in the longer term (Lønsmann, 2014; Vigier & Spencer-Oatey, 2017).

While speaking one's native language contributes to social bonding between NNS individuals and fellow speakers of the same language, it draws a potential line dividing people with different language backgrounds. In several studies of teams using English as the common language, for example, NS of English reported feeling disrespected when their NNS colleagues shift to other languages to communicate among themselves (e.g., Beyene et al., 2009; Kulkarni,

2015; Lønsmann, 2014). In a lab experiment on language-related social exclusion, Hitlan and colleagues (2006) found that excluded members tended to form weak emotional attachment and moral obligation to their work group. Field research conducted by Lauring (2008) further showed that English speaking employees who were excluded from their Danish colleagues' conversations often turned their negative feelings into counterproductive behaviors. This reaction, in turn, activated dissatisfaction from the Danes and polarized language-based subgroups. To prevent this polarization from happening, Kulkarni (2015) suggested that it was important for members in multilingual teams to interpret their colleagues' language choice positively. When people believe that their colleagues speak in an unknown language in order to alleviate cognitive burden or as an inadvertent action, they may hold a healthier attitude towards later interactions with these colleagues.

One fact worth noting is that previous research studied multilingual teams or organizations that were embedded in certain types of language environments. A vast majority of these studies were conducted only in Europe: some included a mixture of people working for different international companies (e.g., Aichhorn & Puck, 2017; Angouri, 2013; Barner-Rasmussen & Aarnio, 2011; Lauring & Klitmøller, 2015; Sorensen, 2005; Tange & Lauring, 2009), while others included multinational employees of one company (e.g., Cohen & Kassis-Henderson, 2017; Fredriksson et al, 2006; Lønsmann, 2014; Neeley, 2013). In addition, several studies were conducted with globally distributed sites of the same European company (e.g, Beyene et al., 2009; Marschan-Piekkari et al, 1999). It remains unknown whether findings regarding consequences of language use in these companies could be transferred into multilingual teams or organizations based in English-speaking countries, such as the United States.

Language Choice and Code-Switching in Multilingual Conversations

The MNC literature introduced above points out that work communication in multilingual teams may happen in a variety of languages. It also provides a detailed examination of the potential consequences of using each language. For instance, using a required working language often puts a heavy burden on NNS of that language; or, having work conversations in everyone's native languages will impede the information sharing and social interaction between language based subgroups. However, this research does not look deeply into when and why people choose one language over others in the first place. A general idea implied by MNC research seems to be that members of multilingual teams choose to use English because it is required by corporate policy (e.g., Henderson, 2005; Neeley, 2013) and start using their native languages to alleviate the burden of speaking English as a second language (e.g., Beyene et al., 2009; Hinds et al., 2014). But are these two factors the only possible ones that drive people's language choices during teamwork?

The current section reviews previous studies that take a closer look at factors driving bilingual speakers' language choices. I first present major sociolinguistic theories that address how language choice is regulated by sociocultural norms at the macrolevel. After that, I review research on accommendation that relates a person’s language choice to their assessment of their audience's characteristics. The work reviewed in the last part of this section highlights the disourse purposes of switching between languages over the course of a same conversation. These theories and findings, although built upon the analysis of language use outside team settings, provide a starting point to think about when and why people would choose each specific language to communicate during different moments of multilingual teamwork.

Language choice regulated by sociocultural norms

There has been a long tradition in sociolinguistics that considers bilingual speakers' language choice as regulated by macro-level issues including social norms, community values, and even political and ideological considerations (Auer, 2013; Wei, 2000). For example, Fishman (1972) elaborates Ferguson's (1959) notion of diglossia suggesting that bilingual speaker's language choice is situated within social domains. Bourdieu and Passeron (1977) describes language choice as a strategy people use to accumulate, exert or mitigate their symbolic capital in terms of, for example, honor and prestige. Myers-Scotton (1980; 1983) claims that language choice is a rational process through which people negotiate their rights and obligations.

Gumperz and colleagues (1971; 1975) developed one of the most widely adopted frameworks for examining code-switching, or moving from using one language to another during the same conversation. This framework claims a dichotomy between situational code-switching and metaphorical code-switching. Specifically, situational code-switching occurs corresponding to changes in the situation, such as who the participants are and what type of activity is being conducted (Wei, 2000). It claims a connection between each social situation and norms of language use in that situation (Blom & Gumperz, 1972). In contrast, metaphorical code-switching is regarded as symbolic of changes in social relationships and expressions of the speaker's intentions. It describes language choice that deviates from the socially appropriate choice maintained through situational code-switching (Wei, 2000).

Accommodation and audience design

Communication accommodation theory suggests that speakers by default follow a convergence process where they modify their way of speaking, such as the speech rate and

lexical choice, to resemble that of their partners; in only exceptional cases, they go through a divergence process to emphasize in-group vs. out-group differences between interlocutors (Giles et al., 1991; Giles & Ogay, 2006; Giles & Smith, 1979).

Scholars have applied communication accommodation theory in research on language choice and code-switching. This research considers language choice primarily as a person's response to his/her audience rather than to macro-level social norms (e.g., Gal, 1979; Giles, 1977; Giles, 1980). It suggests that language choice constitutes an important aspect of audience design: people assess and reciprocate their partners' language choice, level of fluency and so forth. It gives little consideration to other factors, such as the conversational topic or settings (Bell, 1984).

Coding-switching for discourse purposes

Another body of work examines language choice and code-switching at the conversational level (Auer, 1988; 1995). It highlights the discourse purposes rather than the social meaning that drives people's code-switching in conversations (Wei, 2000).

In his book on bilingual conversation (2013), Auer discussed different types of discourse-related code-switching. For example, when a bilingual speaker initiates a question in one language and a bilingual addressee repeats the question using another language, this conversational structure often indicates that the addressee is using code-switching to double check that he/she has correctly understood the initial question. Gafaranga and colleauges (e.g., 2000; 2002), similarly, observed bilingual speakers' code-switching from participants' own perspectives. They found that when speakers were missing exactly the right phrase in one language, they often drew on their other languages to overcome that difficulty.

To summarize, previous literature suggests that bilingual speakers' language choices and code-switching may be motivated by three types of factors: norms of language use in specific

social situations, characteristics of the addressee(s), and specific discourse purposes such as clarifiying prior messages that are formed in a different language. These findings were drawn from research conducted outside the setting of teams, but they provide valuable insights for considering motivations of using a common language vs. one's native language in the context of multilngual teamwork.

Conversational Grounding in a Common Language

In previous sections I reviewed two groups of literature each of which provides insights into one aspect of language use in multilingual teams: the MNC literature, which examines potential concequences of using different languages during teamwork, and the language choice literature, which demonstrates factors that motivate people to choose one langauge over others either at the beginning or in the middle of a conversation. Besides these two aspects, another essential component of language use in multingual teams considers how people handle the concequences of using each specific language.

My earlier review on code-switching litereature has indicated that, under some cirtumistantces, one's willingness to overcome the negative concequence of using one language just motivates them to use another language. For example, when bilingual speakers of English and French run into difficuilty expressing an idea in French, they can switch to English for the purpose of improving the communication effiency. But what if the situation requires an individual to stay within only one languge? Will they still be able to handle the negative concequence, such as difficulties of making themselves understood in that language, during later language use practice?

The current section reviews communication and linguistic studies that looks deep into how conversational grounding, or establishing the mutual knowledge that a message has been

understood as intended (Clark, 1996), works during conversations conducted in only one common language. I firstly introduce Clark's model (1996) that makes general statements of how conversational grounding can be established in dyadic conversations. I then present research that extends the basic model of grounding into multiparty conversations including participants with different roles. After that, I review previous studies that indicate the unique pattern of how informational content and affective content is grounded in conversations including at least one NNS.

The joint grounding process in dyadic conversations

When two interlocutors participate in the same conversation, it is their joint responsibility to make sure that the addressee has understood what the speaker means in his/her utterance (Clark & Wilkes-Gibbs, 1986). The speaker and addressee, regardless of native language, should fulfill this joint responsibility by taking three actions: monitoring their collective purpose for their conversation, visiting and updating their mutual knowledge during the conversation, and contributing collaborative effort to push the conversation forward (Clark, 1996; Clark & Brennan, 1991; Clark & Marshall, 2002; Clark & Schaefer, 1989).

The "collective purpose" of a conversation refers to the goals all interlocutors have for that conversation. Clark and Schaefer (1989) identify the collective purpose as an essential factor that tells interlocutors what information to ground and to what extent. Clark and Wilkes-Gibbs (1986), for example, described a scenario in which a speaker told his home address to an addressee. The addressee may have a high criterion for grounding when the collective purpose of this conversation is to figure out how s/he can get to the speaker's home but a lower criterion for grounding if the two interlocutors are just having a casual chitchat. Here, the collective purpose

directs both interlocutors to generate sufficient common ground cooperatively (Clark & Wilkes-Gibbs, 1986).

An essential coordination device for interlocutors to generate sufficient common ground is by identifying and building on mutual knowledge. According to Clark and colleagues (Clark, 1996; Clark et al., 1983; Clark & Marshall, 1981), there are three ways in which a speaker and address can make use of their current mutual knowledge to communicate a new piece of message:

- **Physical co-presence**: Interlocutors can build personal common ground based on their shared perceptual experience (Clark, 1996). The physical co-presence between the speaker, the addressee and the referent object provides a strong evidence for the monitoring and updating of mutual knowledge (Clark & Marshall, 1981);
- **Linguistic co-presence:** Interlocutors can also build personal common ground by tracing back their shared linguistic experience (Clark, 1996). They refer to information already grounded in their previous conversation history and use that as a basis to ground new information (Clark & Marshall, 1981);
- **Community co-membership:** In addition to personal common ground, interlocutors can also refer to their communal common ground to build up a conversation (Clark, 1996). This common ground is established by community co-membership shared between speaker and address (Clark & Marshall, 1981). For instance, two Cornell students might have the mutual knowledge that both people know what *Slope Day* is.

For building up a successful conversation, interlocutors do not just randomly select any piece of their mutual knowledge to ground new messages. Instead, they tend to choose the coordination device that is most salient with respect to their current mutual knowledge (Clark, 1996; Clark et al., 1983). To achieve this goal, the speaker and the addressee pay collaborative

effort to keep track of what they mutually know and its moment-by-moment updates (Clark & Brennan, 1991). This collaborative effort is revealed in interlocutors' active exchanges of grounding evidence (e.g., Clark & Brennan, 1991; Clark & Wilkes-Gibbs, 1986), cooperative management of the turn-taking sequence (e.g., Schegloff 1997; 2000; Schegloff et al., 1977), message production considering the partner's perspectives (e.g., Fussell & Krauss, 1992; Krauss & Fussell, 1991; 1996), and development of a joint cognitive model regarding how each referent should be conceptualized (e.g., Brennan & Clark, 1996; Brennan et al., 2010).

Multiparty conversations and different roles of participants

In more complex cases, a speaker may have a conversation with more than one audience. To ground the intended meaning of a message properly, the speaker should take into consider not only the mutual knowledge they share with each potential audience but also the specific role taken by each audience (Clark, 1996; McCawley, 1999). Previous research in this space outlines four types of participant roles that may appear during a multiparty conversation (e.g., Clark & Carlson, 1982; Clark & Schaefer, 1987; Gibson, 2003):

- **Speaker:** The person who makes the speech;
- **Addressee(s):** People for whom the speaker's speech is designed;
- **Side participants:** People who are not addressees but who are perceived by the speaker as a part of the conversation;
- **Overhears:** People who listen in on a conversation but are not considered by the speaker to be central participants in the conversation.

People participating in the same conversation usually hold a shared understanding of who is taking which role at a given moment. They establish this shared understanding by monitoring

various types of information, such as the physical distance between interlocutors and the content of each message (Clark & Carlson, 1982).

Conversational grounding between the speaker and the addressee (and/or side participants) is different from that between the speaker and overhearers (Clark, 1996). In many cases, the speaker even intentionally conceals the meaning of messages from overhearers. To realize this concealment, the speaker needs to identify mutual knowledge that is shared exclusively between them and the addressee and then design messages based on this knowledge (Clark & Schaefer, 1987). For example, if the speaker and the address shared the community co-membership of being Arabic speakers, they can make use of this commonality and have private Arabic conversations in front of a monolingual English-speaking overhearer; or, they can design English messages using references that are unique to the Arabic community. In either situation the overhearer can still guess what the message is about but they cannot go through the joint grounding process with the speaker to understand the message (Schober & Clark, 1989).

Grounding in conversations including non-native speakers

In conversations involving at least one NNS of the common language, the efficiency of grounding informational content between interlocutors is often lower than that between NS (e.g., Erickson, 1975; Gass & Varonis, 1985; Gumperz, 1978; Scollon & Scollon, 1995; Tannen, 1981; Taylor & Simard, 1975). Previous research has identified several issues that can disrupt the joint monitoring and updating of common ground between interlocutors speaking different native languages. These issues include but are not limited to: mismatch of communal knowledge (e.g., vocabularies and concepts) between the speaker and the addressee (Clark, 1996), different understandings regarding the pragmatic meaning of a lexical cue (e.g., Cutrone, 2005; Li, 1999;

Nguyen & Fussell, 2014; Young & Lee, 2004), and NNS's non-standard ways of using various discourse makers (e.g., House, 2013; Kumagai & Sato, 2009; Wong, 2000).

A number of studies suggest that people speaking different native languages can develop strategies to resolve grounding problems. In NS/NNS conversations, for example, research finds that NS often actively check the knowledge shared between interlocutors and propose candidate repair plans with increasing specificity (Egbert, 2004; Hosoda, 2000; Varonis & Gass, 1985). They donate more effort than their NNS partners in pushing forward the conversation, because the mismatch of language fluency makes it easier for them to lead the grounding process than for their partners (Arthur et al., 1980; Ellis, 1999; Hosoda, 2000; Kaur, 2011; Larsen-Freeman, 1976; Varonis & Gass, 1985; Wagner-Gough & Hatch 1975; Zuengler & Bent, 1991). In conversations between NNS, research finds that interlocutors usually ask many questions during the grounding process. They use these questions as coordinate devices to initiate negotiations between different lexical choices and ensure the mutual understanding of preceding turns. (e.g., Anderson, 2014; Fernández-García & Arbelaiz, 2003; Shehadeh, 2001; Varonis & Gass, 1985; Yule & Tarone, 1991).

Besides having difficulties in grounding informational content, people speaking different languages also find it challenging to ground affective meanings of their messages. Previous studies on speech acts, for example, have provided rich evidence showing that NS and NNS tend to use different syntactic and lexical modifiers when using a common language to express affect (e.g., Biesenbach-Lucas, 2002; 2004; 2007; Billmyer, 1990; Eisenstein & Bodman, 1986; Mir, 1992). NNS also show lower competence than NS in tailoring their expressions according to different social contexts (e.g., Biesenback-Lucas, 2007; Scarcella & Brunak, 1981). However, little research to date has pointed out how affective content can be better articulated through a

joint process of grounding (Fussell & Setlock, 2014). One possible reason for this missing research is that affect is usually expressed through subtleties of language use. Interlocutors rarely go through an explicit process to indicate their lack of understanding and conduct collaborative repair work as what they do for grounding the informational meaning of messages. Instead, people may seek contextual cues provided through richer mediums to facilitate the communication of affective content. For example, when interlocutors can see each others' facial expressions or voice, they often find it easier to convey and understand affective content (e.g., Buchanan et al., 2000; Ekman, 1983; Hancock, et al., 2007).

To recap, previous sections of this chapter reviewed three lines of work that contribute to an understanding of language use in multilingual teams. Among them, the MNC research outlines possible consequences of using a common language vs. one's native language to conduct team conversations in the field. The language choice literature proposes factors driving bilingual speakers' use of one language over the other either at the beginning or in the middle of a communication. The grounding literature considers how interlocutors ground the intended meaning of messages when they have to stay within only one common language to communicate. However, due to misalignments in research settings and methods, it is hard to directly link together findings from these previous studies and tell a coherent story. In the rest of this chapter, I introduce my current research that looks into the dynamics of language use in the actual practice of multilingual teamwork. This research adds to previous literature by connecting people's motivations for choosing their native language vs. a common language, consequences of the language choice, and how people handle those consequences in their following language use within a unified context of multilingual teamwork.

The Current Study

MNC research reviewed in earlier sections suggests that people may choose from both English and their native language to communicate at work but neither form of language use provides a perfect solution for structuring team conversations. To establish the most successful communication, people have to balance the values and costs of using different languages through their daily practice. Literatures on language choice and grounding have provided concepts and theories related to this practice. However, many questions still remain unanswered in the specific context of multilingual teamwork. What motivates members of multilingual teams to use one specific language rather than others during each conversation? Do NNS come up with any strategies to cope with potential tensions, if any, that arise from using their native language in English speaking teams? How do NS and/or NNS team members develop solutions, if any, to grounding problems that arise when using English as a common language? Answering these questions requires researchers to develop an in-depth understanding of the contextual aspects of language use in teams.

In the scope of my current study, the contextual motivation of people's language choice is examined by collecting evidence from two different yet interrelated angles. The first angle concerns the external information describing the concrete situation of a conversation. This information may include, but is not limited to, the physical and social environment in which a communication event is happening, the conversational participants, the medium of the conversation, and so forth (Hymes, 1967). The second angle considers the internal expectations and concerns people hold during communication within specific situations. These considerations form my first research question, which examines the associations among language choice, the

concrete situation of a conversation (the *when* question) and people's subjective interpretation of the situation (the *why* question):

> ***RQ1: When** and **why** do members of multilingual teams use a common language rather than their native language, and vice versa, at work?*

Further, the nuances of a person's language choice can lead to various consequences regarding information sharing and/or social dynamics among team members (Beyene et al., 2009; Kulkarni, 2015; Lønsmann, 2014). Both empirical and anecdotal evidence suggests that people do not stay passive when encountering negative consequences associated with language choice. For example, NNS can collaborate with their NS partners to repair grounding problems in the common language (e.g., Clark, 1996; Gass & Varonis, 1985; Schegloff, 1997); also, people can exert effort to maintain social relationships with others who may otherwise have little interaction with them due to language barriers (e.g., Aichhorn & Puck, 2017; Cohen & Kassis-Henderson, 2017). However, except for these general claims, there is little understanding of what contextual consequences people will face after choosing each specific language and how they handle these consequences. In response, my second research question aims to provide this missing piece of knowledge (the *how* question):

> ***RQ2**: **How** do members of multilingual teams incorporate various strategies, if any, into the practice of using either the common language or their native language such that they can maximize the values and minimize the costs of their language choice?*

CHAPTER 3

METHOD

To answer my research questions, I conducted in-depth field research with six multilingual teams. This research involves extensive on-site field observation with each team to document communication events that happened during their daily work practice. I also collected people's immediate retrospections on how they interpreted each participant's language use during the communication event. I selected this research method because it allows me to capture the contextual aspects of people's language practices with the most subtlety and vividness. The same goals would be hard to achieve through other methods used in previous studies, such as context-independent surveys (e.g., Angouri, 2013; Klitmøller & Lauring, 2016; Sorensen, 2005) and general interviews (e.g., Aichhorn & Puck; 2017; Barner-Rasmussen & Aarnio, 2011; Neeley, 2013; Tange & Lauring, 2009). The rest of this chapter provides detailed information about my research method, including the sampling strategies, data collection procedures, and my iterative process of data analysis.

Sampling Strategies

The research objective of the current study is to develop a systematic understanding of how people in multilingual teams use language during their daily communication practice. As suggested by Glaser (1978), this type of study usually requires researchers to go through an evolving process of theoretical sampling rather than predefining the whole recruitment plan at once. The sampling process of the current study follows Glaser's recommendations. I iterated through collecting data, generating codes from collected data, and checking and elaborating on these codes by collecting more data. The whole recruiting process can be roughly divided into two stages, as described below.

The recruitment of mosaic teams

Because I was most interested in learning how people use different languages to communicate during their teamwork practice, I started by looking for multilingual teams from a large research-oriented university that met the following requirements:

1) The team must include 4 or more members;
2) The team must use English as its only common language;
3) There should be at least 2 different native languages (including English), each spoken by a subset of members within the team;
4) The team had at least 1 ongoing project that required communication among multiple members of the team.

I use the phrase *mosaic teams* to describe the linguistic composition of this type of team. Similar to mosaic paintings that are usually assembled of subgroups of stones having the same color, mosaic teams consist of subgroups of members who share the same native language. These teams offer an ideal environment for capturing variations of language use in terms of, for example, language choices between English and team members' native languages under a given situation such as formal meetings or informal interaction.

After my initial few weeks spent in the field, I noticed some salient patterns of language use in mosaic teams. For example, NNS of English often took advantage of their native language as a backup plan to communicate information that they felt was difficult or improper to describe in English. I witnessed a large number of cases in which a subset of NNS shifted to their native language for a side discussion in the middle of an English conversation with NS; also, NNS frequently reported that they chose to communicate certain information using only their native language with other colleagues from their own speech community. These observations led me to

suspect that there might be a subtle relationship between when and how people use a common language to communicate and the linguistic composition of the team. I started to wonder whether NNS who do vs. do not have others sharing the same native language within the team would use English to communicate under the same situations and using the same patterns. These thoughts guided me into my second stage of recruitment.

The recruitment of palette teams

During the second stage of recruitment, I started looking for a different type of team while continuing my field work with more mosaic teams. These two types of teams serve as comparison groups for each other, thereby helping me further explore and modify the conceptual categories generated from my initial data analysis.

I use the name of *palette teams* to describe the linguistic composition of the second type of teams included in my sampling. A palette is usually laid with various colors; each of these colors is one-of-a-kind. Similarly, palette teams consist of NNS members who all speak different native languages. These teams allow me to take a closer look at how NNS use a common language to communicate when they do not have the choice to speak with any teammates in their native language. To make these teams comparable to the recruited mosaic teams, I used the following requirements while looking for palette teams:

1) The team must include 4 or more members;
2) The team must use English as its only common language;
3) There is no subset of members who speak the same native language within the team;
4) The team had at least 1 ongoing project that required communication between multiple members of the team.

I iteratively generated codes from my initial data and elaborated these codes using more data collected from both mosaic teams and palette teams (see the section of *analysis* for more details regarding the coding process). Table 1 lists details of the six multilingual teams from the same university in the United States that constituted my final sample. For anonymization purposes, the names of the languages spoken by NNS team members have been replaced by randomly assigned letters.

Type	**Team Number**	**Distribution of NS and NNS of English**	
Mosaic Teams	Team A	NS	4 native speakers of English
		NNS	2 native speakers of C
			2 native speakers of H
	Team B	NS	2 native speakers of English
		NNS	2 native speakers of C
			2 native speakers of H
			2 native speakers of K
	Team C	NS	3 native speakers of English
		NNS	2 native speakers of C
Palette Teams	Team D	NS	2 native speakers of English
		NNS	1 native speaker of C
			1 native speaker of P
			1 native speaker of G
			1 native speaker of A
	Team E	NS	1 native speaker of English
		NNS	1 native speaker of C
			1 native speaker of K
			1 native speaker of F
	Team F	NS	1 native speakers of English
		NNS	1 native speakers of C
			1 native speakers of H
			1 native speakers of K

Table 1. The linguistic composition of observed multilingual teams (the names of languages spoken by NNS were replaced by randomly assigned letters).

All teams included several PhD students and one advisor who conducted research in the STEM field. Some of these teams also had senior undergraduate and/or graduate-level research assistants (RAs) who were involved in idea development, technical execution, and paper writing. All teams had a similar collaboration structure: The PhDs led each research project working directly with each other and the RAs; the advisor supervised all projects using a hands-off style. All NNS of English in these teams had passed the language exams for entering graduate school in the United States (e.g., TOEFL and GRE). Their self-reported level of fluency in English as described in the Interagency Language Roundtable (ILR) scale was above professional working proficiency but below native proficiency.

Data Collection

The whole process of data collection took about 9 months and occurred between July 2015 and March 2016. The full dataset consists of observation notes and interview transcripts generated from about 100 hours of fieldwork for each of the six teams.

Overall procedure

To find qualified teams to volunteer in this study, I firstly identified a list of candidate teams within a large research-oriented university in the United States. I collected general information about each team, such as its linguistic composition and research focus, by reading its website on the university's portal. I then emailed the faculty advisor of each team to introduce myself and express my willingness to conduct research with the team. After getting permission from these faculty advisors, I scheduled a kick-off meeting with each team. This meeting usually took the same slot of the team's regular lab meeting, so that all members of the team would be there and meet me in person. At the kick-off meeting, I presented an overview of my study and got people's consent for observing their daily communication activities in the lab space. I also

took the advantage of this meeting to learn each team's preferences regarding how the observation was conducted. For example, teams that regularly submitted their work to academic conferences did not want to be observed during the week before their submission deadlines. Also, all teams preferred not to have any audio or video recordings of their daily conversations due to concerns about the proprietary nature of the topics of these conversations.

After the kick-off meeting, I conducted preliminary observations with each team. During this stage, no formal data was collected. I attended each team's project meetings and also sat in their lab space (see Figure 1) observing their daily interactions. The main purpose of this preliminary observation was to get acquainted with the team. Over this period, people gradually got used to having me in their labs. We also started learning more about each other, having more casual conversations and building trust.

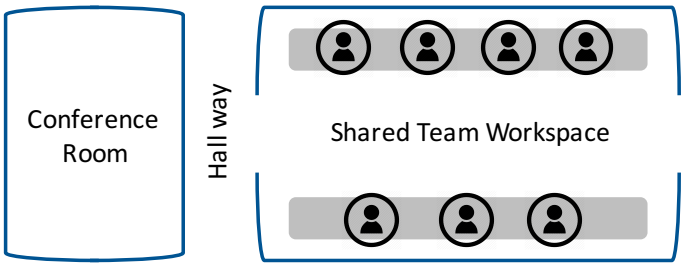

Figure 1. A sketch of each observed team's physical workspaces.

During the formal observation stage, I sat in the same workspace as the team and observed communication events as they happened. Most PhD students in these teams shared their Google Calendars with me, so that I could stay aware of the schedule of their general lab meetings and research project meetings. Further, each team gave me a temporary spot in their lab space, which allowed me to witness spontaneous conversations that happened outside formal meetings. Teams that used online group communication platforms (e.g., Slack or Facebook

groups) added me to their groups and, therefore, I was informed of all online conversations going on in the public channels but not the private ones.

I collected multiple forms of data (as explained below) in order to deepen my understanding of people's language use through triangulation. The whole data collection process contained multiple iterations between coding the current data and elaborating those codes by collecting more data; it stopped once all the core variables were saturated and checked.

Communication event based data

The majority of the data consists of observation notes, transcripts of immediate retrospections, and supplementary materials revolving around each communication event. More specifically, all the observation notes were recorded manually. They documented six aspects of information that describe the concrete situation of a conversation, including:

1) Scene: The physical/social environment in which a conversation is happening;
2) Participants: People attending a conversation; their roles and relationships;
3) Outcomes: The final outcome of a communication event;
4) Form and Characteristics: How people do turn-taking, switch between topics (if any) and ground meanings;
5) Manner: How people use different tones, gestures, expressions and references;
6) Channel and Language: What channels (e.g., online vs. face-to-face speaking) and languages (e.g., English vs. Mandarin) are used;

Whenever possible, I asked people to reflect immediately after a communication event they just participated in. This retrospection allowed me to understand how people interpreted key aspects of their language use during the conversation, including:

1) Perceived Norms: What rules are followed by attendances of the event;

2) Genres: Whether the conversation can be categorized as a meeting, a chitchat and etc.;

3) Communication Experience: Expectations and concerns of conducting certain acts during the conversation; interpretations on others' behaviors.

Further, I also collected some images and screenshots donated by participants. This supplementary information captured how people used various tools (e.g., online translation services) and materials (e.g., whiteboards) to facilitate their communication when needed.

General reflection based data

In addition to observations and retrospections based on each communication event, I did semi-structured interviews to learn people's general experience of communication during teamwork. This interview addressed four aspects of language use:

1) General background: Interviewee's self-estimation of his/her language ability; self-defined cultural identity; work experience within the current team; collaboration history with other team members;

2) Habitual language use: Expectations, benefits and concerns of using each language;

3) Habitual technology use: Expectations, benefits and concerns of using each technology;

4) Cultural experience: Positive (e.g., intimacy) and negative (e.g., misunderstandings) cultural experience during work communication.

Analysis

All the observation notes, interview transcripts and supplementary materials were imported into ATLAS.ti 1.0.50 for data analysis. To maintain the natural structure of the data, I

linked observation notes and interview transcripts by putting information related to the same communication event together. All communication events were then nested within teams. I followed an inductive approach guided by the grounded theory to explore the data (Corbin & Strauss, 1990). The whole procedure of data analysis was completed through multiple iterations of open coding, axial coding and selective coding.

Open coding

During the open coding phase, I read through the whole set of data several times and generated initial codes and labels to exhaust the data. These labels revealed various categories and their properties regarding language use in multilingual teams. I then continued testing and refining the initial codes as more new data was added to the analysis. For instance, there were initially quite a few codes used to describe a workplace conversation. Some of those codes were adopted from participants' self-reports (e.g., *a tap-on-the shoulder conversation*), while I created others based on my reading of the observation notes (e.g., *work-break chat*, *water-cooler conversation*, *random chat* and etc.).

As the open coding was moving forward, these labels gradually merged into one top-code of *informal conversations*. Then sub-codes, such as *communication medium* and *language type*, were assigned to describe various attributes of these *informal conversations*. At the same time, I also developed a code of, for example, *formal meetings* in parallel with *informal conversations*. These two codes captured the contextual information of a communication event, and the difference between them was marked by the code of *level of formality*.

Axial coding

In the axial coding phase, I explored the relationships among different conceptual categories by iterating through both the data and related literatures. For example, there was a

salient association between *perceived participants shift* and *the speaker's language shift* under the context of *informal conversations*; the behavior of *language shift* led to the consequence that some initial participants of a conversation were going to *be excluded* from later parts of the same conversation.

I relied on three types of information to identify the relationships among categories: the sequential order of codes as it naturally emerged from the coding process, the perceived relationships between thoughts and behaviors people reported in the interviews, and the theoretical connections between concepts as indicated by previous research. By continuously comparing my inductive codes with previous theories, I gradually refined the substantive codes into more theoretical ones.

Selective coding

During the selective coding phase, I identified *language shift*, the practice through which people move back and forth between using English and their native languages, as a core category emerging from my field data. It reveals how people draw on their mundane wisdom to balance values and costs of using multiple languages at work. I then went back to review and refine all the rest of the codes for the purpose of relating other categories to this core category. Through this process a more coherent story emerged that described the dynamics of language use in these multilingual teams. The following chapter presents my research findings in full detail.

CHAPTER 4

FINDINGS

In general, my data suggest that NNS members in the multilingual teams I observed often shifted back and forth between English and their native language when having work communication in various contexts. This language shift happened not only in mosaic teams consisting of subgroups of NNS who shared the native language but also in palette teams in which NNS did not have the choice to speak their native language with other teammates. The use of native languages instead of English sometimes raised interpersonal tensions between team members from different speech communities. Depending on the context, people improvised various strategies to avoid or resolve these negative social concerns.

Further, when team conversations had to be conducted in English, people relied on their physical co-presence, linguistic co-presence and community co-membership to ground information that initially failed to be grounded. Materials, human resources and technologies available in the contextual environment greatly contributed to which type of co-presence people relied on to ground their messages and the way in which this grounding occurred. This pattern held for both mosaic teams and palette teams.

Finally, the language use of individual members affected how information sharing and interpersonal dynamics were structured at the team level. People speaking different native languages worked collaboratively to fulfill the team's goal of incorporating information across language boundaries.

The rest of this chapter presented details of the above research findings in three sections. For anonymization purposes, I recode part of the information in observation and interview quotes: The names of languages spoken by NNS were replaced by randomly assigned letters (e.g., C

refers to language C), and name of participants were replaced by IDs linked to native language (e.g., C1 and C2 refer to different NNS speaking language C). People's demographic background (e.g., gender and age) and roles in a team did not show clear association with those identified patterns of language use.

Language Shift Between English and Other Languages

My first set of findings describes when, why and how NNS members in multilingual teams shifted between languages in different communication contexts, including formal meetings, informal conversations, instant messaging and personal note taking. Among them, the first three contexts concern interpersonal communication between teammates; therefore, my analysis of these contexts was mostly based on data from mosaic teams where speaking a shared native language among a subset of NNS was possible. The last context considers NNS's intrapersonal communication with oneself, which was covered by data from both mosaic teams and palette teams.

For each context, I draw on observation notes and/or interview data to demonstrate the norms of language use, NNS's language shifts and their association with other shifts in the conversation, and other team members' reactions to language shift (if any).

Language shift and content shift at formal meetings

In each team, I observed several formal meetings. Some of these meetings were general group meetings at which one person presented on his or her work and received feedback from the rest of the team. Others were project meetings at which a subset of team members discussed specific issues regarding that project. These meetings always required advance preparation, including setting an agenda, negotiating a meeting time, and booking a conference room. Finalized information was announced to all participants via group email or online messages.

Through this process, people inferred that these meetings were formal and only for work discussions. As one of our interviewees described:

> *At the meetings, we really need to discuss the research and stay focused. That time is not reserved for a random friendly conversation. That time is reserved to figure out the research and see how we can make it as good as possible. [E7, NS, Team C]*

Norms of language use. When participants spoke up at formal meetings, they stated that their language use was subtly guided by their perception of the interpersonal and physical atmosphere of these meetings:

> *Everybody is expected to speak English at formal meetings, because we need to make sure our thoughts are shared with everybody in this room. Sometimes when I speak, I know maybe I'm not using the best way to express an idea in English, but I just try my best. [C1, NNS, Team A]*

> *At meetings, my rule of thumb is that everyone in this meeting room should understand what I say. There won't be the situation where someone is excluded just because of the language. We share professional discussions, and we use English. [H3, NNS, Team B]*

As indicated by the quotes given above, the use of English was perceived as a norm at formal meetings and it was respected by all members of these multilingual teams. Our observation on the actual language use at meetings further confirmed the adoption of this norm.

Language shift and its association with content shift. I witnessed language shift in a very small proportion of formal meetings. The following segment of my observation notes documents a typical case of this kind of shift in mosaic teams:

At some point, H1 tried to make a comment on the idea C2 just proposed. H1 said "so maybe we can first make a prototype with the…". H1 made a pause here while looking toward H2. H1 then said something in [H] using a rising tone. H2 replied "oh, you mean Play-doh" and smiled. H1 nodded and said "oh, with the Play-doh" and continued to the next speech. [Group meeting, Team A]

During the immediate retrospection afterwards, H1 gave a detailed explanation of his/her language shift:

I didn't finish that sentence in English, because I didn't know the exact word in English. I got stuck there. So I asked H2 for help and explained what I wanted to say in [H]. If it is in writing, I usually stop and Google it. But when talking in person, I ask the question out because it keeps the flow of the conversation. My question is very short anyway. [H1, NNS, Team A]

The above case of language shift, consistent with other cases I observed, showed that NNS in mosaic teams might use their native languages in formal meetings when they encountered speech content that they could not accurately express in English. This content, as I observed and heard from interviewees, usually referred to non-academic vocabularies and/or knowledge that was initially adopted in non-English education.

Language shifts at formal meetings usually ended within just one or two speaking turns. Through the shifts, NNS tried to solve potential grounding problems collaboratively with people who shared their native language. Once this goal was achieved, they shifted back to English immediately. This intentional downplay of using their native language suggests NNS's perceive the norm of language use to be English under this specific communication context. They

expressed social concerns regarding the appropriateness of their language choice behavior. It held NNS back from speaking their native language among themselves.

In special cases, NNS even took advantage of technological resources available in the communication context to hide their language shift behavior from others. During my observations of team A and team C, I witnessed a few meetings that happened between remote team members working on the same project. At two of these remote meetings, NNS who speak the same native language were collocated at one office while an NS colleague participated in the meeting from a distant location. I observed at both meetings that the collocated NNS sometimes muted their audio and then shifted to their native language for a quick exchange of information. The following excerpt of my observation notes documents one of these moments:

> *C5 and C6 (collocated) were having a Skype meeting with E9 (remote). They shared the same laptop and dialed E9's number online. The goal of this meeting was to prepare the slides of a presentation they were going to give together at a later time of this week. C5 started first. While he was speaking, E9 interrupted in and asked a few questions ... After 6 minutes, C5 turned to C6 and asked "How to explain X [refers to the name of one concept] in English? Can you give a further explanation when it is your turn of speaking?", and C6 replied "Sure, leave it to me". This quick coordination happened in [C]. Before C5 started this conversation, he clicked the mute button (and the video was always off) to block E9 from hearing. He unmuted the audio input and continued his speech in English right after he got C6's reply. [Remote meeting, Team C]*

In the immediate retrospection after this meeting, C5 and C6 reported that they muted the audio input because they "*do not want to confuse the other person. He may feel it's weird if he*

hears a language that he cannot understand. Also, it (refers to speaking non-English) may be a bit improper for a 3-person conversation".

Consistent with the other examples of collocated formal meetings, the above example suggests that NNS's language choice was shaped by their considerations regarding both conversational grounding and social appropriateness. While shifting to their native language allowed NNS to resolve potential grounding problems faster, it was perceived as a behavior that challenged the social norm of communication at formal meetings. To balance the pros and cons of using multiple languages, NNS developed their own strategies of language use. They kept exchanges of information in their native language short in front of other team members. When it was possible, they even took advantage of technological resources to direct others' attention away from the language shift. Figure 2 illustrates the general pattern of language shift I observed at formal meetings.

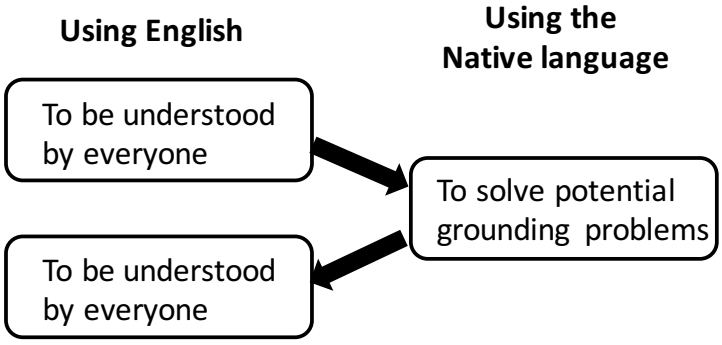

Figure 2. The general pattern of NNS's language shift at formal meetings.

Reactions to language shift. In all the cases I observed, there were no negative reactions from other teammates when they perceived NNS's language shifts at formal meetings. People reported that they were fine with this temporary use of an unknown language, because "*it's short and it's clear from the context that they are trying to figure out something we all understand* [E9, NS, Team C]".

Language shift and participant shift in informal conversations

Informal conversations were mostly conducted in a team's workspace rather than the conference room, and they comprised the vast majority of communication in all observed teams. Spontaneity was identified as the most important feature of informal conversations by almost all interviewees:

> *When we talk at our seats, the conversation could be about everything. It could be I run into a problem about work, so I ask another person a question. It could also be random chat, or many things mixed together. This is why I feel it's different from conversations at formal meetings. There is a lot of freedom. Other people can join and leave your conversation at any time. [C1, NNS, Team A]*

> *Most of the time, we just turn to each other and say hey and we start talking. It's more like spontaneous interactions, like talking about something that we are doing at the moment. I just sit there and I spontaneously decide I may need someone's input on this or I'm going to use something for the next step. [E8, NS, Team C]*

Norms of language use. When people initiated an information conversation, they usually started by picking one specific addressee rather than talking to a whole group of people as they did at formal meetings. The addressee was usually claimed through either gestures (e.g., tapping a shoulder, gazing at someone) or verbal announcement (e.g., calling one's name). When the speaker and the addressee spoke different native languages, as in all informal conversations of palette teams and many conversations of mosaic teams, they used English as a common language. When the conversation happened between NNS in mosaic teams with a shared native language, however, they often started the conversation in their native language rather than English. My

interviews indicated that NNS, regardless of which native language they spoke, were highly aware of this norm. NNS interviewees in mosaic teams further described their native language as the default way to communicate with other teammates who are from the same speech community:

> *I think [C] is the default language for me to have face-to-face conversation with another [C] speaker. It's just our natural way of talking. It is the language for us to best express ourselves and understand others. [C2, NNS, Team A]*

> *When I talk to K2 in the office, we usually talk in [K]. It's natural and it's more intimate and efficient. We chat about research and we chat about life. Everything in our one-on-one conversation is in [K]. [K1, NNS, Team B]*

One interesting observation regarding NNS' language use was that they often inserted English words or phrases into their speech although the main body of their conversation was in their native language. These inserted words were always theoretical concepts and/or technical terms. NNS reported that they kept these words in English because they could not find equivalents in their native language. As one of the interviewees said:

> *When H3 comes to my seat, we often talk in [H] because it's easier to build your speech. But some technical terms are a little bit awkward to translate. There might be counterparts of them in [H]? But I don't know what they are. So we say them in English and insert that into [H] conversations. [H4, NNS, Team B]*

Language shift and its association with perceived participants shift. Although informal conversations between NNS members in mosaic teams often started in their native language, I observed many cases in which NNS shifted back and forth between their native language and English. This language shift happened on a daily basis during work communication in all three mosaic teams. Data analysis indicated a close association between NNS' language shift and

shifts in the perceived conversational participants. More specifically, since informal settings in the workspace do not set a clear boundary of who can or cannot participate in a conversation, the same participant may play different roles as the conversation goes on. Here, I adopt vocabulary from previous literature (e.g., Clark & Carlson, 1982; Clark & Schaefer, 1987; Gibson, 2003) to differentiate four basic types of participants: the speaker, the addressee, the side participant, and the overhearer. The first three types of participants are considered as the central participants of a conversation, whereas the last type represents peripheral participants. Building on this vocabulary, I present three selected examples from the observation notes. Each example described language shift in association with one specific form of participant shift.

Example 1: Overhearers vs. Addressees as identified by Explicit Role Indicators

C5 and C6 were having a casual chat at their seats in [C]. In the middle of this conversation, E8 walked into the office, sat down, and said "hey guys, how are you doing?" in English. The three people then started chatting about each other's research and life, all in English. This conversation lasts for about 4 minutes. Then E8 took out a laptop and started replying to emails. Soon after this, C5 said something short to C6 in [C]. C6 replied a short sentence also in [C]. The conversation ended after C5 left the office. [informal conversation among 1NS and 2NNS who speak language C, Team C]

In this example, the two NNS shifted languages when E8 entered the conversation. During the immediate retrospection, C6 reported that they shifted from language C to English because "*E8 said hi to us, so we felt maybe we should include E8 into our conversation*". Here, the fact that E8 issued greetings and explicit attention to C5 and C6 promoted a shift of his role

in the conversation as perceived by others. Along with this perceived participant shift, the speaker's language shifted from language C to English. The use of English stopped once E8 distanced himself from the conversation and became just an overhearer.

The above example and similar cases indicated some external cues the speaker may rely on to identify another's participant role over the course of a same conversation. I call these external cues *explicit role indicators* because they are based on information located in the physical environment of a conversation and therefore publicly visible to everyone in the environment. In the current field data, explicit role indicators that identify the central participants of a conversation include:

- **Physical distance**: The speaker tends to perceive others who stand close to them as the central participants of the conversation;
- **Gaze interaction**: The speaker tends to perceive others who use gaze to deliver explicit attention to them as the central participants of the conversation;
- **Verbal intervention**: The speaker tends to perceive others who issues verbal intervention into a conversation as central participants of the conversation.

NNS speakers continuously attended to these explicit role indicators and monitored their changes during a conversation. They shifted between languages to maintain the social appropriateness of their language choice in terms of including all the central participants. In cases where using English to include additional audience members impeded NNS's ability to communicate among themselves, they suspended part of the conversation and continued after the additional audience member left the conversation.

Example 2: Overhears vs. Side-Participants as identified by Implicit Role Indicators

H3 walked to H4's seat and initiated a conversation in [H]. H4 replied, also in [H]. While they were talking, they faced each other and exchanged gaze. After three rounds of turn-taking, H4 suddenly said something in English, "You know there will be a talk this week, right? It's about X [refers to the research topic]. I feel it's very related to your project and maybe also others' in our group". H3 replied, "cool, I will check that", also in English. This whole conversation lasted for just a few minutes. It ended when H3 walked away. While this conversation was happening, most people in this team were just seating in the workspace and working on their own stuff. [Informal conversation between 2NNS who speak language H, Team B]

This example shows an interesting case in which the speaker used different languages as s/he assigned different roles to people who were not the direct addressee of a message. As H4 reported in the immediate retrospection, they used language H during the first part of the conversation because "*we were talking about one of H3's papers, so it's not related to others. I don't think it deserves other's attention. They may not even care about it*". However, as the conversation went on, they mentioned a talk that was related not only to H3's work but also to other people's research in this team. H4 then shifted to respond in English, with the consideration that "*other people might find that information useful as well*". Here, people who were initially overhearers became side-participants; the shift to English allowed them to share in the information exchanged by their NSS teammates.

In contrast to Example 1, Example 2 shows how the speaker relied on implicit role indicators instead of explicit ones to infer others' roles in a conversation and adjust language choice accordingly. I use *implicit role indicators* refer to knowledge stored in an NNS's mind

about the interests and other characteristics of their teammates. In Example 2 and similar cases, the NNS speaker compared the topic of the ongoing conversation with his knowledge regarding each of the overhearers' interests. Once NNS speakers realized that there was a potential overlap between these two lines of information, they shifted between languages turning overhearers into side-participants. This language shift behavior is motivated by the belief that there is a social responsibility for people working in the same team to share useful information with each other when possible.

Example 3: Addressees vs. Side-Participants as Manipulated by Language Shift Markers

E1 and C2 were having an English conversation at their seat about a technical problem they encountered while working on a project. After 3 minutes of talking, they went to C1 for some suggestions. The three people then stood in a circle and continued the conversation, still in English. At some point, C2 looked at E1 and said "give us one minute, we will discuss this [refers to several candidate solutions] in [C]". E1 smiled and said "okay". C2 and C1 then shifted to [C] to continue the discussion. Both people talked much faster than when they were talking in English. E1 stood there quietly looking at them talking. After about 2 minutes, they shifted back to English and said "okay, we found a solution". They then explained the solution in English to E1 in two sentences. While this whole conversation was happening, E2 and H1 were sitting in the workspace working on with their laptops. [Informal conversation among 1NS and 2NNS who speak language C, Team A]

In contrast to the other two examples, Example 3 presents a case in which NNS shifted to their native language in the middle of an English conversation. As it is found across all cases similar to this, the segment of native language communication was usually separated from the rest of the English communication by a shift-beginning marker and a shift-ending marker. In Example 3, specifically, C2 marked the beginning of language shift by giving E1 a heads-up in English (e.g., "*give use one minute, we will discuss this in [C]*"), and the end of this shift was marked by the two NNS indicating in English a closure of their conversation in language C (e.g., "*okay, we found a solution*"). These markers were provided intentionally for "*being polite*" to other participants in the conversation. During the immediate retrospection, C1 and C2 both reported that they shifted to language C to improve the efficiency of the technical discussion. As C2 described:

> *We used [C] because it's way more efficient for problem solving. That discussion was about a lot of very detailed things, like many possible methods and also many terms. There were things that I didn't know if I could express precisely in English, and I believe it's the same for C1. But we have no problem getting everything clear in [C]. [C2, NNS, Team A]*

Here, the language shift conducted by two NNS led to a potential conflict regarding the participant role of their NS teammate. Although all the explicit (e.g., physical distance) and implicit role indicators (e.g., the interests in topic) still suggested that E1 should be a central participant of the conversation, E1 would not be able to understand the conversation anymore once C1 and C2 shifted languages. In other words, E1 was turned from a direct addressee to a side-participant because of the language shift.

Both C1 and C2 were aware of the upcoming shift in E1's participant role. They used language shift markers as a technique to maximize the benefit of their language choice while minimizing the cost. These language shift markers worked as a "role-holder" that indicated NNS's acknowledgement of their NS teammate's role as a central participant in the conversation. Once the two NNS finished the discussion in their native language, they officially included E1 again by shifting back to English and updating E1 on what had been discussed. In this way, NNS took care of both the grounding efficiency of the conversation and the social appropriateness of their language choice. However, It is worth noting that the update was given as a summary rather than in detail. C1 explained that they omitted the details because "*the solution itself was what really mattered for all of us*".

Taken together, the analysis presented above shows that NNS's language shift in informal conversations was closely associated with shifts in perceived conversational participants. They developed various strategies, such as paying close attention to explicit/implicit role indicators and issuing language shift markers, to balance the pros and cons of using different languages to communicate. Figure 3 diagrams the general pattern of language shift I observed in informal conversations.

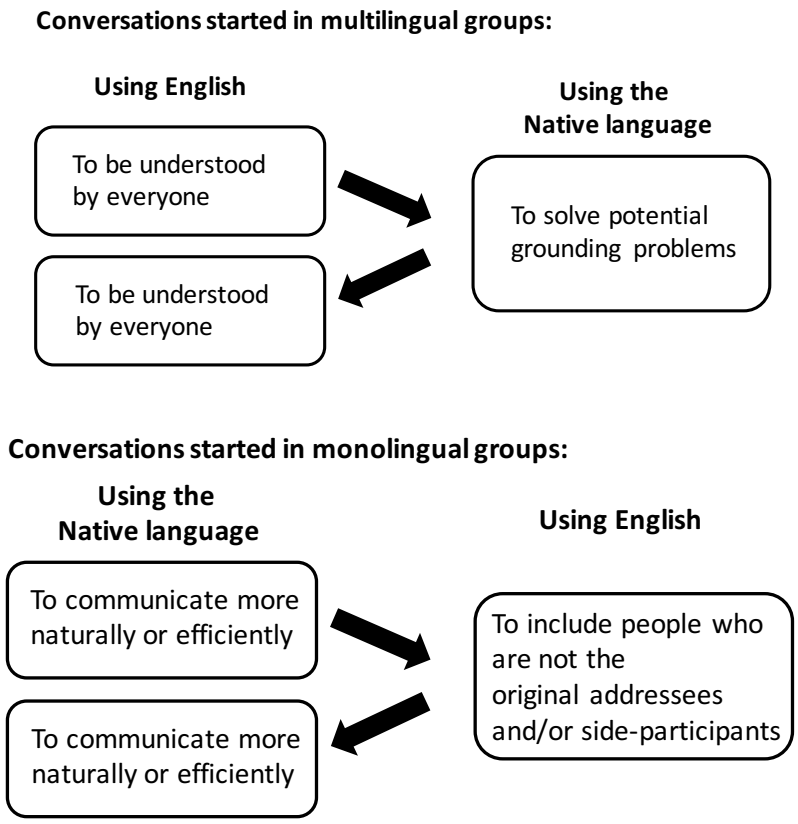

Figure 3. The general pattern of NNS's language shift in informal conversations.

Reactions to language shift. Overhearers of these informal conversations reported mixed feelings about NNS's language shift. All interviewees reported that they would not mind their colleagues speaking a different language for making the conversation more efficiently. However, many of them also expressed concerns about being excluded from discussions that they should have been included in:

> *I would prefer people in the lab to speak a language that we all understand, because, you know, sometimes that makes me feel excluded. I don't mind if they are just talking about their personal stuff. There is no reason for me to be involved in those conversations. But I would like to be involved in work related conversations. Maybe I could contribute something to those conversations, you*

know. But again, I feel it would be rude to say 'hey, please speak English'. [E8, NS, Team C]

This interviewee pointed out an important issue that was confirmed by most other interviewees across all three mosaic teams, that is, understanding the main topic of a conversation matters a lot to overhearers. People would love to understand research discussions that are related to the shared interests of the team, but they usually did not mind others talking about minor details of their own project or their personal life in a different language. Thus, when NNS were willing to explain the main topic of their work-related conversations, as happened in Example 3, other people always reported this as something they highly appreciated.

When NNS would not share the topic of their native language conversation voluntarily, other people sometimes relied on certain cues to guess the topic of the conversation. A primary cue mentioned by most interviewees was English loan words inserted in non-English conversations. People reported that these English words enabled them to get a sense of the conversation:

(I can) sort of say they are talking about this or that, even though I don't really understand what they are talking about [E5, NS, Team B].

Language shift and medium shift in Instant Messaging

I also looked at how people conducted online communication through IM in mosaic teams. Two of these teams relied on Slack to set up online communication. On the Slack page of these teams, there are a number of group channels built for sending out announcements to the whole team or having project-centered discussions among specific subsets of team members. People could also set up one-on-one chat on Slack by clicking another person's name and creating a private channel. For mosaic teams that didn't use Slack, online communication was

mainly conducted via Google Hangout. All students on each team had Google accounts associated with their work email addresses assigned by the university. People could sign into Google Hangout by opening either the client-side application or the Gmail webpage.

During my observations, I saw people keep their Slack or Hangout window open once they arrived at the office. Some people also installed the mobile application of these IM platforms so that they could receive messages even without a laptop. People perceived both Slack and Google Hangout as communication platforms specifically for the team's work conversations. As some of our interviewees said:

> *Slack is the place where we talk about work coordination, or ask research related questions, or many other things about working in this group. All the people you can see on this Slack page are people you work with here. You won't add your friends out of work into this channel. Also, all conversations here are organized under themes, that's usually the name of each project. It helps us structure the messages, and it's good. [H2, NNS, Team A]*

> *We use Google Hangout to discuss about work online. For example, I get an idea for the next step of the research, so I send it to other people through Hangout. We also talk on Hangout to discuss the time for a meeting. It's mostly only for work, maybe because it's connecting with your work Email. The whole network here is your professional network. [C5, NNS, Team C]*

Norms of language use. I asked people in mosaic teams to open their Slack or Hangout conversation history and reflect on their language use. Interestingly, the conversation history showed that NNS rarely exchanged messages in their native language on either platform.

During the interviews, many NNS reported that they used English for these IM conversations intentionally, so that messages could be found more easily in the future:

> *I try to use as much English as possible here [refers to Slack], because we are talking about the research and these messages are archived. I may want to review or even copy some of this content when I write papers in the future. That will be in English. I don't do publications in [K]. Face-to-face conversations don't have such record, so there is no other use of a conversation outside the current physical environment. [K1, NNS, Team B]*

> *On Hangout I only text in English. I know my English is not perfect, but conversations here are always about work and they are archived. There is a benefit of using English here. When I go back and search for stuff using keywords, it's always easy to do it in English. I'm actually not sure how the search would work in [C]. It's like when you are using Google scholar, you never search a keyword using [C]. [C6, NNS, Team C].*

In addition to concerns about the long-term functionality of messages, some NNS interviewees further pointed out that IM allowed them to "*double check the grammar and adjust the wording with the help of online dictionaries before a message was sent out* [C1, NNS, Team A]". Thus, they usually felt it was easier to use English at IM conversations than in face-to-face conversations.

Language shift and its association with medium shift. Slack and Hangout were online platforms used by NNS to have work discussions in English, but they were not the only platforms for these discussions. During the observations, I witnessed many cases in which NNS used their personal IM platforms, such as WhatsApp or Facebook Messenger, to have both work-

related and personal conversations. On these platforms, NNS always shifted to their native language to communicate with fellow speakers of that language. NNS explained during interviews that these local IM platforms "*were initially set up for contacting friends rather than colleagues, so there is little sense of obligation to use English* [C3, NNS, Team B]".

By comparison, it is clear that NNS's language use during instant messaging is largely shaped by their beliefs about appropriate language choices on each specific online platform. They perceived using their native language and English as the more appropriate way to communicate on personal IM platforms and work-centered platforms, respectively. Further, using English on work-centered platforms could simplify future work conversations along the same topic. There was a challenge that NNS might have limited ability to form and/or interpret messages in their second language. However, this challenge turned out to be less of a concern for NNS, because they usually gained sufficient time translating unknown words and editing messages during instant messaging.

Reactions to language shift. My interview data indicated that people were usually not aware of others' online conversations outside Slack or Google Hangout. However, some interviewees reported that there was reason to expect NNS with the same language use their local platforms to communicate. One of the interviewees said:

> *They [refers to NNS who share the same native language] probably communicate to each other through other channels, and I will never be a part of those conversations. I don't know if that's actually true or not, but that's the expectation. [E5, NS, Team B]*

Language shift and anticipation shift for personal note taking

In addition to interpersonal conversations between teammates, another important component of work communication concerns the intrapersonal processes through which people exchange information with themselves. In all the six observed teams, I noticed that people conducted note-taking as the primary form of this intrapersonal communication. Most of these notes were taken just for a person's own use rather than sharing with others. People often kept these notes at places that were only accessible to themselves, such as personal notebooks and Evernote managed through private accounts. They pointed out in their interviews that taking personal notes helped them keep track of important information. This information was documented intentionally for future review:

> *I write it [refers to the personal notes] for myself. It records things like what I did and how I moved on. Many of the information is actually important and you need them to reflect on what you are doing for the next step. You should write this information down at somewhere and you can look back on it when there is a need. [G5, NS, Team E]*

> *Usually when I write down this type of notes, I am in the middle of analyzing something and I get some ideas. For example, if I change this part, will the result be different? There are many possibilities here, like, I can change this variable alone, or I can change the combination of several variables. So I just quickly note those thoughts down. The next time I continue the analysis, I need the notes to remind me of what I was considering. [K2, NS, Team B]*

Norms of language use. Unlike the other communication contexts described in previous sections, people did not perceive clear norms of language use for personal note taking. I asked

NNS in both mosaic teams and palette teams to open their personal notes and reflect on the language of the notes. Most of NNS' notes were in mixed languages, although the proportion of content written in each language differed case-by-case (see Figure 4).

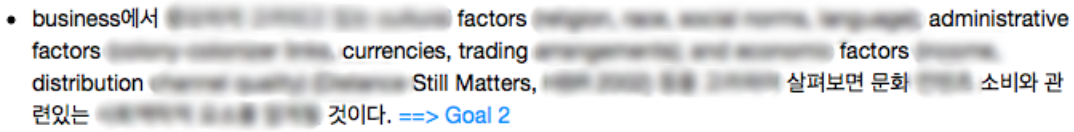

Figure 4. An example of bilingual notes written by NNS (some of the noted information is blurred for anonymization purposes).

NNS interviewees reported that they simply chose the language that required the least mental effort at that moment. For instance, they used native language for note taking when they needed to document down their original and/or unstructured ideas, but they used English to record thoughts and comments given by others during English conversations.

> *I wrote down these thoughts in [K] because in that way I could summarize things more concisely. It is faster. For example, here [pointing to one page], you see? These lines are in [K]. The reason is that these are some unstructured thoughts and some logic related steps. In this case, [K] is easier. It actually contains much more meanings than just using English. [K3, NS, Team F]*

> *These notes were taken at my meeting with F1. They are all in English [pointing to several lines of notes]. I think it's because our meetings are always in English. It does not make sense if I converted his words into [C] to note down all his comments. At those moments, my working memory operates in English. [C9, NS, Team E]*

Language shift and its association with anticipation shift. One interesting phenomenon I discovered from both observations and interviews was that NNS often rewrote their personal notes into a different language after the notes were initially taken. During the interview, NNS related this language shift to the shift of anticipated usage of the noted information. More specifically, when people anticipated that they were going to quote the noted information at formal meetings or online work discussions, they would "*go back to resort the notes and translate those non-English parts into English* [C7, NS, Team D]". In contrast, when people anticipated that they were going to discuss the noted information with others from their own speech community, they sometimes added keywords written in their native language to summarize content captured in earlier English notes.

There is often a time delay between the moment notes are initially generated and the moment when notes are actually used. This delay offers NNS the opportunity to handle positive and negative consequences of their initial language choice separately. Since most notes are not publicly shared at the moment they are taken, NNS chose the language that was easiest for them. Once there was an anticipated context for using the noted information, NNS could revise the notes in a language that works best for conversational grounding and/or social interaction in that context.

Language shift across contexts

Language shift not only happened during conversations within in each specific context (e.g., formal meetings, informal chat, instant messaging and personal note taking), but also appeared when people exchanged information regarding the same topic across different communication contexts.

During the observations and interviews, I found cases in which NNS conducted informal conversations in their native languages and took advantage of these discussions to improve their later participation in formal English meetings. People reported that these informal conversations allowed them "*to polish the ideas better beforehand and make the later English meetings way more efficient* [H1, NNS, Team A]". I also witnessed cases in which NNS set up a series of conversations on the same research idea across different languages and mediums. As a result, it usually,

> *requires extra effort to translate all the information between languages and integrate them together, so that the information could be shared with the whole group at the later stage (of the research) [C4, NNS, Team B].*

The sequential shift of languages across contexts had complex effects on both informaton sharing and interpersonal dynamics at the team level. Elaboratioins of this point are presented in the third section of this chapter.

In sum, my first group of findings demonstrates when, why and how NNS members in multilingual teams used English rather than their native language, and vice versa, under different four communication contexts: formal meetings, informal conversation, instant messaging and personal note taking. I found that NNS conducted language shift when they perceived associated shifts (e.g., content shift, participant shift, medium shift and anticipation shift) attaching to each specific communication context. They tried to maintain both the grounding efficiency and the social appropriateness of their behaviors while using multiple languages at work. When it was difficult to achieve both goals at the same time, NNS developed context-based strategies (e.g., using available technologies, issuing language-shift markers, taking advantage of the time delay) to balance the positive and negative consequences of each specific language choice they made.

Conversational Grounding in English

Using one's native language helps NNS ground conversations efficiently among themselves. This option, however, is not always available during all work conversations. For NNS who work in palette teams, they simply have no one else to communicate with in a shared native language. For NNS who work in mosaic teams, findings presented in the previous section indicate that the communication norm of certain contexts requires people to use only English regardless of their language background.

My second group of findings concerns how members of multilingual teams ground information in English. Specifically, I focus my analysis on communication events in which people initially failed to ground a piece of information but then used various techniques to fix the grounding problem. From my field data, I identified four types of information that people had difficulty grounding in multilingual teamwork. Among them, the first three types of information can be grounded using shared physical co-presence, linguistic co-presence and community co-membership as suggested by Clark (1996), respectively. The last type of information concerns personal feelings and casual topics exchanged during social chats. My data showed that people tended to conduct medium choice to avoid this kind of communication when they perceived potential difficulties of grounding.

For each type of information, I draw on observation notes and/or interview data to examine the perceived challenges of grounding, solutions based on different types of co-presence or medium choice, and resources required to ensure each type of co-presence (if any).

Conversational grounding related to concrete objects and physical co-presence

A significant proportion of my observation data captured situations where members of multilingual teams exchanged information revolving around concrete objects. These objects

included physical material and equipment used to conduct research, everyday objects distributed in the work environment, tangible artifacts designed based on people's original ideas and so forth. Efficient grounding of this information was important for the success of teamwork.

Perceived challenge. NNS members of multilingual teams often found it challenging to accurately name certain objects in English. They attributed this challenge to the fact that their "*classroom English only covers a tiny part of things that people will actually talk about at their work and daily life* [P1, NNS, Team D]". During the study, many NNS interviewees shared stories of when they could not find a proper word to name an object during the conversation and felt embarrassed about that. NS members in the observed teams also pointed out that sometimes the canonical way of naming an object would not work in their conversations with NNS teammates. They felt their language skills "*have been challenged so much, coz it can be really hard for a native speaker to explain what the thing is in other words* [E2, NS, Team A]".

Physical co-presence as a foundation for grounding. My observation notes documented many cases in which people relied on their physical co-presence to ground information regarding concrete objects. This technique turned out to be especially useful for NNS who could not come up with efficient verbal expressions to identify the intended objects. The following excerpt of observation notes presented one of these conversations:

> *H1 walked towards C2 and initiated a conversation with him in English. He asked C2 "have you checked the… hmm… the water thing?". C2 gave a puzzled face and responded, "the water thing?", also in a question. The two people then exchanged several turns trying to figure out what object H1 was actually referring to. They tried different expressions to call that object, but none of them worked. Finally, H1 noticed that there was a machine stored under one table in*

the office. He pointed to the top part of that machine and said "this one. I thought you locked it in the room next door." C2 looked at the machine following H1's pointing and replied, "oh that! yeah, it's already fixed". [Informal conversation between two NNS speaking different native languages, Team A]

In this example, two NNS were trying to build a mutual understanding regarding an object the initial speaker referred to. They encountered grounding problems because neither of them knew the accurate word to call this object. This example indicates two attributes of NNS's language use that were commonly shared across other similar communication events.

One of these attributes concerns the intuitive way NNS often name an object. In this example, H1 and C2 both used several expressions, each of which consisted of an adjective and the word *thing,* to describe the intended referent. This type of expression is called a dummy noun phrase or dummy compound (e.g., Clark & Wilkes-Gibbs, 1986; Hohenhaus, 2000). It usually indicates that the speaker was uncertain about how efficient their expressions were for the purpose of conversational grounding, which was confirmed by NNS's self-report during the immediate retrospection. In the above example, H1 picked the expression of "*the water thing*" because he thought that, "*one important feature of that part of the machine was to generate water for cooling"*. However, it turned out that C2 did not recognize this feature as the most salient one for identifying a unique object.

The other attribute considers NNS's future language use after they already established common ground regarding the intended object. In the above example, physical co-presence, along with demonstrative gestures (e.g., pointing), helped two NNS build a strong mental connection between the referred object and the non-standard English expressions they developed to name this object (Clark, 2003). In later conversations I observed, these two NNS continued

using "*the water thing*" to refer back to that part of the same machine, although both of them believed that there should be better ways to name the same object in standard English..

Resources required to ensure physical co-presence. There is no guarantee that a physical reference will always be available to assist with grounding whenever people need to refer to it. During my observations, I witnessed a lot of cases in which members of multilingual teams relied on various material and technological resources to establish physical co-presence between them and the objects they needed to refer to. Among the six observed teams, four had large-size whiteboards installed in the public workspace. Team members often used these whiteboards to sketch the objects they wanted to refer to. Similarly, team members often used white paper to draw pictures of objects they failed to communicate successfully using verbal English alone (see Figure 5).

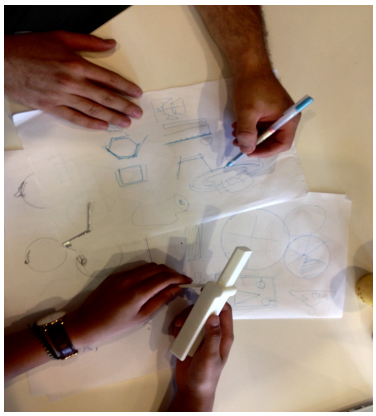

Figure 5. The use of papers to facilitate communication

Another resource people often relied on to create the physical co-presence between interlocutors and the referred object is Google Image Search. In many occasions, NNS used their native language to generate search keywords and presented the retrieved image to their teammates. Here, using keywords written in their native language allowed NNS to accurately name objects that they would not be able to name in English. NNS preferred not to use the English translation of those keywords, because,

> *When the translator gives an English word I don't know, I have no clue to estimate whether the translation result is right or wrong; we still need to check the visual image (linking to that word) together [K1, NNS, Team B]".*

Conversational grounding related to processes and linguistic co-presence

Besides conversations regarding concrete objects, people also experienced many difficulties grounding references related to logics and processes. These processes described how the collaborative work should be conducted by introducing task flows, design schemes, logic structures and so forth. My observations and interviews suggested that people usually developed a shared understanding of these processes at the initial stage of their teamwork. In later stages, these processes got referred back to again and again as the teamwork moves forward.

Perceived challenge. When people communicated the detailed meaning of a research process or a design scheme for the first time, they often relied on physical co-presence as demonstrated in the previous section to establish shared knowledge. They drew diagrams and sketches in shared visual space to ground understanding of how the process should be like. This technique was proved as an efficient one even for explaining complex logic structures and sequential relations between multiple items. However, problems often appeared when people referred back to these processes at later stages of their teamwork. During observed conversations, it was common to see that people did not draw diagrams and/or make extended explanation of a process at every time they referred back to it. Instead, they tended to develop short terms to label the process for a more convenient reference. Miscommunication often happened when multiple NNS adopted different terms to label the same process.

Linguistic co-presence as a foundation of grounding. I witnessed a number of cases in which NNS speaking different native languages generated different terms referring to the same process or used similar terms referring to two completely different processes. When people could not detect and clarify the confusion on time, their work progress got held up.

One research project conducted in team E offered a representative example of conversational grounding under the aforementioned situation. In this project, two NNS (F1 and K4) developed the research idea of using visualization techniques to facilitate voice message based communication. At the first project meeting, they generated three alternative research plans. Each plan suggested a different way of prioritizing which components of a voice message should be visualized. After this meeting, F1 and K4 had a few follow up meetings as well as informal conversations discussing which research plan should be adopted into the practice of system building. F1 referred to the plan he recommended as "*the landmark plan*", while K4 referred to the same plan as "*the indexing plan*". It took them a long time to realize that they both were actually voting for the same plan. During the retrospection, they explicitly explained how the confusion arose:

> *As we were getting deeper into the discussion, we got annoyed by each other's language a little bit…We wasted a long time then realized that we were actually thinking of the same thing. F1 was saying the idea using his own words, and I was saying it using my words. It was a stressful communication. [K4, NNS, Team E].*

In the above example and similar cases, people tried to take advantage of their shared linguistic co-presence (e.g., established mutual knowledge of the three research plans) to ground further information more efficiently. However, since they failed to figure out a unified way of referring to the correct piece of their mutual knowledge, miscommunication happened and the work coordination was disrupted.

Further, interviews suggested an interesting association between how NNS used linguistic co-presence to ground information and how they assessed a colleague's level of fluency in English. More specifically, NNS often reported that they felt the term generated by

their NNS teammates were "*shaky*", "*sloppy*" or "*dubious*". This perception motivated them to propose their own terms rather than figuring out what their teammates meant. As a consequence, multiple expressions were introduced into the conversation and this increased the likelihood of miscommunication.

Resources required to ensure linguistic co-presence. To make the best use of their prior linguistic co-presence, people developed the strategy of going through an explicit procedure to define short labels for complex processes. In the example presented earlier, F1 and K4 finally adopted a unified vocabulary to refer each research plan after a NS (E16) teammate joined their project. E16 quickly noticed that,

> *There are some different terms F1 would use to mean the same things as what K4 was saying and all of those terms are… They are just not as bound to the conventions of the native colloquialisms. They sometimes come up with novel terms for things that people, at least me or any native speakers, would use a different term for. It is very very confusing. [E16, NS, Team E].*

They then organized a three-way project meeting, and E16 proposed a unified vocabulary to refer each research plan.

As observed in this example and similar cases, people working on the same project often needed to generate a unified vocabulary as a shortcut for citing knowledge from prior linguistic co-presence. This unified vocabulary was usually proposed by two types of people on the team: NS of English and/or experts in the related research domain. These people acted as important human resources that facilitated team communication, because their superior knowledge in English and/or domain-specific language enabled them to "*reconcile different opinions and terminologies (proposed by others) and bring everyone on the same page* [E16, NS, Team E]".

Conversational grounding related to concepts and community co-membership

Another important part of team conversation concerns how people establish mutual understanding regarding abstract concepts, such as nomenclatures and idiomatic expressions. For the research-oriented teams observed in this study, discussions revolving around abstract concepts and terms were a central part of their daily work.

Perceived challenge. Members in observed teams generally found that it was difficult to explain an abstract concept to someone who spoke a different native language. A big part of this difficulty comes from the fact that most abstract concepts cannot be explained using tangible references. Instead, the speaker has to figure out some other information already known by the audience and then try to build connections between their prior knowledge and the new concept.

By analyzing the observation and interview data, I identified four detailed methods that a speaker usually used to explain an abstract concept to the audience. Some of these methods were also indicated by previous research on communication strategies (e.g., Dörnyei & Scott, 1995; 1997):

- **Categorization**: Placing the new concept into a group of related concepts, so that the audience can infer essential attributes of this new concept. A typical language used for this grounding technique is "*A is a type of ...*";
- **Contextualization**: Putting the new concept into a scenario where this concept could be applied, so that the audience can infer the pragmatic meaning of this concept. A typical language used for this grounding technique is "*Usually when ... happens, we can call it A*";
- **Analogizing**: Comparing the new concept with another concept that is quite different from it. It is based on the assumption that these two concepts share implicit properties

along significant aspects. A typical language used for this grounding technique is *metaphors and similes*;

- **Translation**: Typing the new concept into bilingual dictionaries or online translation tools and showing the audience the translation output.

Among these four methods, categorization, contextualization and analogizing are also common methods used by NS speakers to ground abstract concepts among themselves in, for example, expert-layman conversations (e.g., Bromme et al., 2001; Bromme et al., 2005; Jucks & Bromme, 2007). A central step during this grounding process is to determine the addressee(s)'s prior knowledge so that it can be used to build connections, contexts and/or metaphors for explaining the new concept. This step turned out to be a larger challenge when conversational participants spoke different native languages. One NNS interviewee explained the challenge like this:

> *I often feel less certain about what this person already knows if he is from a different country and says a different language. It's much easier to infer that if this person is a [P] speaker. Let's say, I'm going to explain a concept to a [P] college student. I know how to read his background. He already entered our national university and passing that entrance exam means he must already know a certain list of things. You know what to expect from this person before talking to him. But if the conversation is with an American student or an Asian student, what should I expect from them? [P1, NNS, Team D]*

Community co-membership as a foundation of grounding. People may use a variety of cues to infer what the audience already knows before trying to ground a new concept. For example, the analysis presented in earlier sections demonstrated that mutual knowledge

established in prior conversations was quite useful for grounding further information. However, as Clark (1996) has argued, people may find it difficult to keep track of all information exchanged in previous conversations. In addition, people who do not have much interaction history share only limited mutual knowledge based on linguistic co-presence. In that case, people may refer to the community co-membership to assess their current common ground and use that as an anchor to ground further understanding of new concepts.

For members of the six observed teams, observation and interview data indicated two categories of community co-membership that people primarily relied on when trying to communicate abstract concepts. One category concerns shared membership in disciplinary-based communities. For instance, NS (E11) and NNS (C7), who hold degrees in Electrical Engineering, often used concepts developed from that field as a metaphor to ground new information. Similarly, since a NNS (H3) knew that the other NNS (K2) was an expert in Fine Art, he intentionally used art-related scenarios to explain new concepts induced into their conversations.

The second category relates to social and cultural communities. Interestingly, grounding of abstract concepts was more efficient in conversations between NNS from similar cultures but speaking different native languages than between NNS from dissimilar cultures. During interviews, NNS speaking different East Asian languages frequently mentioned that it was easier for them to communicate certain concepts among each other rather than with English-speaking teammates. Similar experiences were also reported by, for example, speakers of Arabic and Persian working on the same project. The following quote from a [K] interviewee pointed out how socio-cultural group co-membership simplified the grounding of abstract concepts between he and his teammates:

When I tried to explain something conceptual to others, often I feel that [C] speakers can get it but English speakers cannot. I think this is because these concepts have their counterparts in both [K] and [C] but maybe not in English. So when we transfer those things into English conversations, we use them as a tool to explain new information. But with English speakers, these tools dysfunction. [K3, NNS, Team F]

Resources required to ensure community co-membership. In interviews, people pointed out several information resources that helped them identify shared community membership with their team members and, thereby, facilitate the grounding of abstract concepts. One of these resources was the shared physical lab space. It allowed team members to infer others community memberships by collecting convenient cues, such as the topics of the books someone was reading or the type of websites someone usually visited.

In addition to the shared physical space, team members also learned each other's community memberships by paying attention to their online social profiles and posts. This learning process was highlighted especially by interviewees whose teams established online Slack channels and/or Facebook groups. For instance, one of the default conversation channels on Slack is called the *#random* channel. Most teams interpreted this channel as a place to share information related to people's personal interests, have casual conversations and organize team-building activists (see Figure 6). People pointed out that conversations in this channel helped them "*infer who has expertise in what field beyond the research space we all work on within this team* [G1, NNS, Team D]".

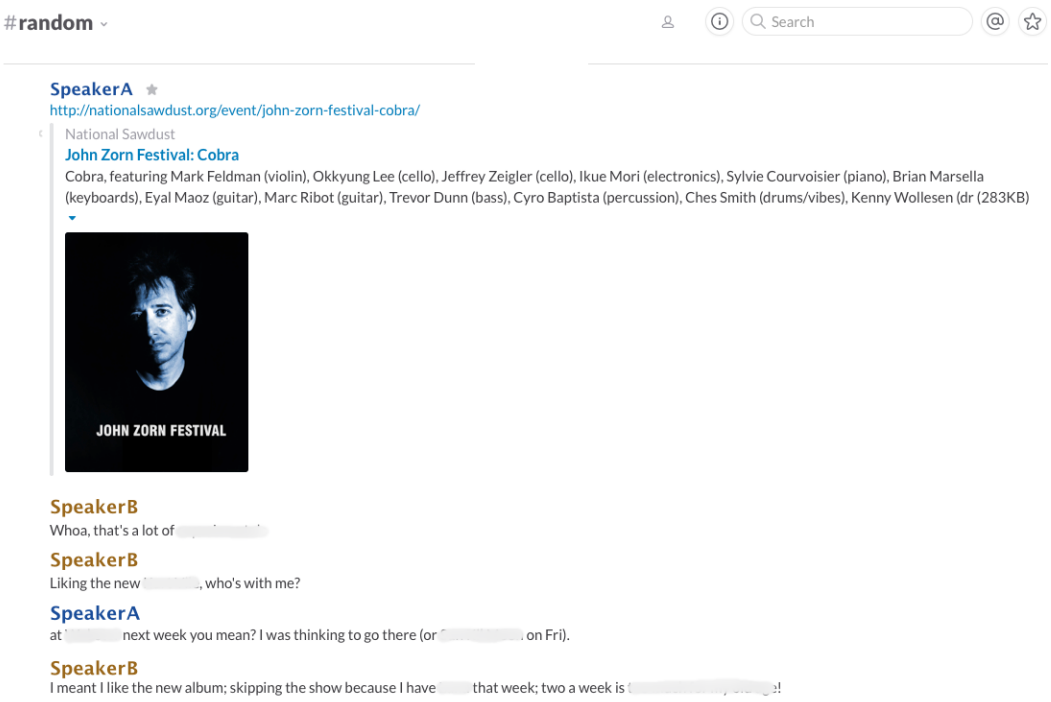

Figure 6. A screenshot of conversations in one team's *#random* Slack channel (some of the exchanged information is blurred for anonymization purposes).

Also, when people encountered difficulties explaining abstract concepts in English, they sometimes went to Wikipedia or Google Translation for explanations in English or across languages, respectively. Specifically, Google Translation was used primarily when the audience "*actually understands this concept but doesn't know how to call it in another language* [E2, NS, Team A]". In contrast, Wikipedia was more often used to provide an interpretation of a concept in English. People looked up this information to find "*some detailed examples and scenarios* [C4, NNS, Team B]", so that they could better explain the concept through contextualization and/or categorization.

Conversational grounding related to social conversations and medium choice

Grounding information in a common language often requires people to put in a lot of effort. When speakers foresee grounding challenges in an upcoming conversation, they

sometimes would avoid having that conversation altogether instead of devoting effort to solving the challenge. In the teams I observed, this phenomenon was especially common for social conversations.

During interviews, people described social conversations as moments when they aimed to "*sharing laughs and tears*", "*trying to be humorous in small talks*", or "*seeking for emotional empathy*" with others. NNS often experienced serious anxiety about having these conversations in a second language:

> *I understand that having social chats are good for building relationship between colleagues. I tried, but it was very difficult. When we talk about research, I know what I should say; the problem is mainly about how to organize my language. But in small talks, I don't even know where to start. I sometimes just avoid these conversations, because I don't want to feel embarrassed. [C6, NNS, Team C]*

> *I don't talk much about details of my personal issues to them [refers to teammates speaking other native languages). I think the point of those conversations is not for delivering information to understand the work better; it's more about letting them have empathy with me. It requires a higher level of understanding of my situation and also more delicate understanding of my language. I don't expect this happen in English conversations with others. [K4, NNS, Team E]*

NNS's reflections as presented in the above quotes show that they thought social communication using a common language would require a lot of effort to ground the affective meaning of messages and this effort would not be work-related. Therefore, when the primary purpose of communication was about getting work done, NNS often perceived that it was fine to avoid having social chats.

A common strategy NNS used to avoid social conversations was to initiate the communication via online platforms rather than face-to-face. In teams using Slack, for example, communication norms of selected channels allowed NNS to avoid the potential awkwardness of needing to engage in small talk. NNS reported that they often went to project-centered Slack channels to initiate direct work discussions. Those channels were interpreted by everyone as spaces reserved for professional conversations only. Thus, NNS could skip the social chitchat that happened at the beginning of most face-to-face conversations.

One drawback of using online platforms was that the affordances attached to IM tools often limited NNS's ability to convey affective meaning. When this problem happened, NNS reported that they shifted back to face-to-face conversations for "*précising the tone (of messages) through facial expressions or the pitch of voice* [H3, NNS, Team B]".

To sum up, the second group of findings demonstrates how NS and NNS team members resolve grounding challenges when they must use English as a common language. My field data indicated four types of information (e.g., concrete objects, processes, abstract concepts and social content) that multilingual teams frequently found difficult to ground. Members of the observed teams drew on different types of co-presence as suggested by Clark (1996) to ground this information. They also took advantage of materials (e.g., whiteboards and papers), human resources (e.g., team member who held superior knowledge in certain domains) and technological resources (e.g., online social profiles and Wikipedia) to ensure and strengthen different types of co-presence. When NNS perceived that it would be too effortful to ground social content irrelevant to their work purpose, they avoided this kind of communication through medium choice.

The Effects of Using Multiple Languages at the Team Level

Earlier sections of this chapter have indicated that members of multilingual teams can choose from both English and their native languages to communicate based on their situational needs. They also make improvised use of various resources embedded in the contextual environment to ground information in English and/or avoid interpersonal tensions related to speaking other languages. Building on these findings, the rest of this chapter addresses the effects of using multiple languages beyond the scope of each individual communication event.

Information management and communication transparency

In both mosaic teams and palette teams, having information communicated in different languages increased the difficulty of information management at the team level. People understood that the only way to share knowledge across the whole team was to discuss everything in English. However, they were also aware that many work related conversations actually happened in non-English languages through both visible (e.g., informal conversations in the public workspace) and invisible channels (e.g., online chat through private platforms). Many members of the observed teams explicitly mentioned that it would be "*a worth-millions-of-dollars idea*" if they could figure out how to integrate multilingual information related to the team's common goals efficiently. Unfortunately, none of these teams reported that they had developed a satisfactory plan to do so.

One typical communication model I observed in mosaic teams was that the spread of one research idea among all team members often occurred through a recursive process (see Figure 7). NNS members often preferred to explain their ideas first to team mates who shared their native language. During this stage, NNS polished their thoughts without worrying too much about the linguistic expressions they used. When these ideas were developed into a more mature form,

some of the NNS who felt more comfortable speaking English would pass the information to other NS or NNS from a different speech community. After collecting others' comments, NNS sharing the same language discussed those comments amongst themselves again. They iterated through these stages to continue their communication with the rest of the team. One NNS interviewee working in mosaic teams shared his interpretation of the information management model as described above:

> *Not everyone feels comfortable speaking up in English at public. Language fluency is one factor, and maybe also public speaking anxieties. I notice that sometimes K1 had some thoughts about the research going on in this team, but for some reason he didn't say it in public, he just told that to K2. But later K2 told those thought to me, and also to the rest of the group at our big meeting. This may not be the optimal process, but this is how those thoughts come out and get spread eventually. [H4, NNS, Team B]*

In palette teams, people had to conduct all their work discussions in English. However, when there were serious problems with conversational grounding in English, NNS reported that they occasionally reached out their native-speaking fellows outside the team to seek comments and advice. Many of these conversations remained unnoticed by others, but they helped NNS better prepare their ideas before sharing them with the whole team.

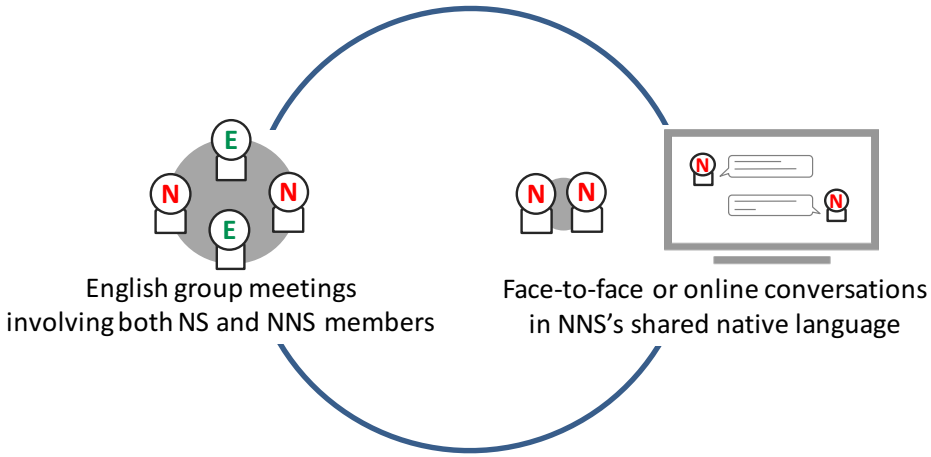

Figure 7. The flow of information sharing across languages and contexts (N refers to NNS and E refers to NS of English).

Almost all interviewees, regardless of the linguistic composition of their teams, pointed out that they relied on the weekly group meeting as the main venue to integrate ideas held by different team members. People felt that it was important to be fully prepared before the group meeting, so that there could be a sufficient exchange of thoughts. Off-meeting conversations in non-English languages played an important role in the preparation stage.

Tacit responsibilities assigned to monolingual vs. bilingual team members

While people explored and constructed the dynamics of language use in observed teams, they took up social responsibilities that were tacitly assigned during the communication practice. In mosaic teams, for example, some NNS reported that they had become the "*hub*" connecting NS teammates and other NNS sharing their native language. In both mosaic teams and palette teams, NS members frequently pointed out that they had gradually become the ones who "*reconcile different terminologies (between NNS teammates)*", "*proofread and fix grammatical issues for others' papers*", and "*clarify the (English) message in a different way (for NNS teammates)*". These facilitators, due to all the extra load they had been taking on, were often

described by their teammates as core members of the team even if they started working in the team later than others.

Further, many NNS in the observed teams believed that it was their responsibility to bring information from outside the English world to their teammates. This behavior helped multilingual teams fulfill their potential of absorbing diverse information at a global scale:

> *Having people speaking different languages makes our team outperform other (monolingual) teams. For example, there are several labs in [G] doing really advanced research in our field. G1 can easily learn information about recent work conducted in those teams; I cannot, because I don't read [G]. When we are chatting with each other, G1 often share the information he knows with the rest of us. It's also the same for me. I know some [C] institutions doing impressive work in our field, by reading articles and following news media in [C]. I always share this information with the team. [C7, NNS, Team D]*

> *C5 and C6 are more aware of services that are offered in their language. I know very little about that. When we run into a technical problem, they know how to find out information from resources existing in another language, but I'm only aware of an English speaking internet, so it's really helpful to exchange information with them. [Q: how did you realize they were getting information from those resources?] They've mentioned that and I was surprised that we could find helpful information from outside the English world. [E8, NS, Team C]*

As a brief summary, the current chapter presented three groups of findings from my field research with six multilingual teams. Among them, the first group of findings concerned when, why and how NNS chose English over their native language, or vice visa, during their daily

communication practice. The second group of findings demonstrated how people resolved grounding challenges when they had to rely on English to communicate. The third group of findings concerned how the use of different languages influenced information sharing and social coordination at the team level. The next chapter discusses the potential contributions of these findings to an understanding of language use in multilingual teams.

CHAPTER 5

DISCUSSION

The findings of my dissertation research unpack contextual aspects of language use during work communication in multilingual teams. They extend previous MNC and language choice literatures by digging deeper into when, why and how NNS members use English vs. their native language to communicate. They also add to previous research on conversational grounding by demonstrating how different technologies are used to facilitate multilingual conversations in real workplaces. The rest of this chapter specifically discusses four issues regarding the dynamics of language use and its effects on communication in multilingual teams: language shifts driven by situational needs, conversational grounding in English based on three types of co-presence, the role of technology in current multilingual teamwork, and design implication for future communication and collaboration technologies.

Language Shifts Driven by Situational Needs

Consistent with findings from previous MNC studies (e.g., Feely & Harzing, 2002; Lønsmann, 2014), the current research found that NNS did not use their team's common language or their native language alone for all conversations. Instead, they chose between different languages based on the context. There was a strong association between NNS's language shift and their interpretation of the most salient need in each context.

Formal meetings set up a context in which the entire team sought to establish common ground. My interviewees indicated that the use of English enabled both NS and NNS to satisfy this contextual need. Previous work on language choice and code-switching found that bilingual speakers temporarily switched to another language to clarify content that could not be grounded in the current language (e.g., Gafaranga, 2000). NNS in my current study used a similar practice

as a strategy for building common ground in English conversations with a multilingual audience. Furthermore, my analysis showed that NNS tried to minimize the salience of their language shifts during formal meetings. They shifted to their native language for just one or two turns and then shifted back to English immediately or they had informal discussions in their native languages prior to formal meetings. These behaviors helped maintain the social norm of language use at formal meetings as suggested by previous sociolinguistic studies on language choice (e.g., Gumperz, 1975; 1977).

Although some earlier MNC research reported cases in which NNS had lengthy discussions in their native language at English meetings or even converted the rest of the meeting to their native language (e.g., Hinds et al., 2014; Lønsmann, 2014), I found no similar cases during my study. One possible explanation for this difference is that the macro language environment of my teams differed from that of other studies. Much previous research (e.g., Barner-Rasmussen & Aarnio, 2011; Hinds et al., 2014; Lønsmann, 2014; Marschan-Piekkari & Vaara, 2005) was conducted in multinational organizations located in non-English speaking countries. Thus, NNS of English may perceive their local language as having equal legitimacy in the workplace as English (Lønsmann, 2014). In the current study, however, all teams were from a university in the United States where the local language is English. While language switching does occur in this setting, it may be that because the local language and the common language are the same there are additional pressures to keep use of non-English short in formal meetings.

In addition to formal meetings, informal communication also plays a crucial role in teamwork especially during task execution and when sharing knowledge between co-workers (Isaacs et al., 2002; Whittaker et al., 1994). Previous research on language choice has indicated that NNS living in English-speaking countries prefer to communicate with fellow speakers of

their native language using that language during informal conversations (e.g., Yuan et al., 2013). The current study extends this work by digging deeper into how NNS use different languages to communicate in the workplace. Specifically, my study found that NNS often perceived two different but interlaced needs during informal conversations: to properly include certain participants in a conversation and to maximize the efficiency of conversational grounding. Language choices that addressed one need might fail to fulfill the other. As demonstrated through my examples, two NNS might communicate most efficiently in their native language, but this language choice excludes others from the conversation. At the same time, speaking English allows both NS and NNS to be included in the same conversation, but it hinders NNS's ability to express complicated thoughts. Every time NNS opted for English vs. their native language, their choice generated ripple effects on later stages of the conversation. NNS then made further language shifts as these rippled effects occurred. During language shift, NNS paid close attention to explicit and implicit indicators of other participants' roles. They also used shift markers to help balance the benefits and costs associated with choosing a language.

When NNS communicate using work-focused IM platforms, their language use was closely associated with the perceived affordances of the medium. More specifically, since messages exchanged via IM are usually archived, this tool allows people to review, search, and reuse the content of their earlier conversations. The use of English further consolidates the long-term functionality of IM messages by simplifying the process of information retrieval. In the field of computer-mediated communication (CMC) and computer-supported cooperative work (CSCW), substantial research has examined the use of IM for lightweight communication (Birnholtz et al., 2005), work coordination (e.g., Nardi et al., 2000), and multitasking (e.g., Isaacs et al., 2002). While these studies emphasized the immediate delivery of IM messages, little

research has examined the "archiveability" of IM messages and its influence on teamwork. The current study helps address this question by connecting the archiving of messages and NNS's language use in multilingual teams.

Further, my observations showed that NNS usually shifted to their native language when having work-related conversations on personal IM platforms and/or when conducting informal workspace conversations that were not noticed by others. This use of hidden channels can decrease communication visibility at the team level (Dennis et al., 2010; Leonardi, 2014). Using NNS's native languages within these channels can further intensify the lack of communication visibility between subsets of people who speak different languages. In my current research, multilingual teams used their weekly group meeting as a central venue to synchronize information held by different team members. Also, certain members of the team acted as communication facilitators bridging both information exchange and social interaction across people speaking different native languages. The kinds of language based social discrepancies found in previous MNC research (e.g., Hitlan et al., 2006; Kulkarni, 2015; Neeley, 2013; Vigier & Spencer-Oatey, 2017) did not appear to be a serious issue in my sample. It is possible that differences in the organizational environment and the nature of work conducted in these teams contribute to this inconsistency in findings. Future work will be needed to understand why some multilingual teams function better than others.

When it comes to personal note taking, data from the current study indicated that NNS usually anticipated when and why they would use the noted information at a later point. This time delay served as a buffer zone that separated the short-term and long-term consequences of language choice during note taking. When taking notes, NNS often only considered their own cognitive load and chose whatever language was easiest. Once the specific context of using the

noted information became clear (e.g., formal meetings, informal discussions or IM conversations), NNS went back and rewrote or annotated the notes in a different language.

In sum, findings from my study indicate different patterns of language use during work conversations in multilingual teams. NNS may conduct multiple language shifts over the course of a single communication event. They may also do sequential language shifts across different communication events in order to establish mutual knowledge at the team level. Previous research on MNC and code-switching have pointed out that there are both pros and cons of people's language choices. The current study contributes to that body of literature by demonstrating how people devise context-specific techniques to satisfy their most salient situational needs while diminishing the costs.

Conversational Grounding in English Based on Three Types of Co-Presence

When the specific communication context (e.g., formal meetings and/or informal NS/NNS conversations) require everyone to speak English, it raises the question of how efficient grounding can be achieved in a common language. Previous research has pointed out several issues that may lead to a lack of efficiency in common language based conversations. For example, NNS sometimes do not know the right word to deliver their intended meanings (e.g., Day et al., 1984; Gass & Varonis, 1985; Li, 1999). In addition, interlocutors speaking different native languages may hold inconsistent interpretations of the same speech act (e.g., Eisenstein & Bodman, 1986; Mir, 1992). Members of the multilingual teams in my sample developed a set of context-based strategies to facilitate conversational grounding despite the various challenges they encountered. Detailed examination of these strategies can contribute to the grounding literature.

More specifically, my research showed that people frequently relied on the three types of co-presence suggested by Clark (1996) when grounding information during work communication.

Each type of co-presence was the most efficient tool for solving certain types of grounding issues. For example, when the challenge was mainly to refer to a concrete object, people made use of physical co-presence between interlocutors and that object (or its virtual representation) to ground their messages. When the challenge involved referring back to a complex process previously discussed, people tried to figure out the most efficient way to ground information based on their linguistic co-presence. Different types of co-presence provide grounding evidence with various levels of strength (Clack & Marshall, 1981). The current study extends this point by identifying the most powerful grounding device associated with specific conversational contexts.

Further, my field data suggested that a team member's assessment of physical co-presence, linguistic co-presence and community co-membership with addressees influenced the way they designed their messages. This echoes previous lab studies on lexical choice (e.g., Brennan & Clark, 1996) and perspective taking (e.g., Krauss & Fussell, 1991) by showing how people take advantage of resources embedded in their work environment to facilitate message production. When two NNS tried to ground information regarding a concrete object, for example, the physical co-presence between them and the object allowed them to communicate successfully using dummy nouns. When NNS tried to generate efficient labels for complex referents (e.g., processes), they created the vocabulary in collaboration with NS teammates. This vocabulary was then used in later work conversations to activate their linguistic co-presence. When faced with difficulty explaining abstract concepts, members of multilingual teams checked information spread in both their physical workspace and virtual communication platforms to infer community co-memberships. Mutual knowledge implied by these co-memberships then pointed people to words, examples and metaphors that could be built into their explanations of the new concept. These findings imply that successful communication in multilingual teams may not require all

team members to speak perfect English, but it does require some ability to solving grounding problems using context-based techniques.

When information was too difficult to ground in English, NNS had two types of reactions. In some cases, they considered how to avoid having the conversation at all. For example, when NNS found it was too difficult to participate in small talk with NS, they tried to avoid social conversations by pushing the interaction onto work-centered platforms. In other cases, NNS held conversations in their native language to support later grounding in English. Findings regarding language shifts captured this pattern of language use in the teams I observed.

The Role of Technology in Multilingual Teamwork

Communication in modern organizations is getting increasing technology-dependent. Little empirical research, however, has been conducted to examine whether and how multilingual teams draw on computer-based technologies to support work conversations in the field (Hinds et al., 2011; Gibson et al., 2014). As one step toward filling this gap, my study found that technology played an important role in multilingual teams' daily communication practices. When members of these teams ran into challenges related to language use, they developed improvised use of selected technologies and intentionally avoided using other technologies depending on the communication context. These findings add to our understanding of how multilingual communication is conducted in today's information age.

At English formal meetings and informal conversations, specifically, my findings suggest that NNS in mosaic teams sometimes shift to their native languages in order to translate words and expressions. Although recent lab studies in the field of CSCW have indicated the possibility of using machine translation (MT) to support real time conversations (e.g., Yamashita & Ishida, 2006a; 2006b; Wang et al., 2013), I observed little use of MT in sample. Instead, NNS

interviewees mentioned that interacting with translation tools can break the natural flow of a face-to-face conversation; therefore, they intentionally chose not to use MT when they could get translation help from other teammates. My observations with palette teams found that people occasionally used Google Translation to help clarify meanings of abstract concepts. This practice, however, was qualified by the assumption that the other person already knew the semantic meaning of these concepts. These findings indicate that people's decisions about using MT were largely regulated by how well the technology could fit into the natural flow and norms of communication in a specific context.

Further, my findings suggest that a considerable amount of communication in the observed teams occurred via computer-based platforms. Some of these platforms, such as the Slack channels, support interpersonal conversations; other platforms, such as Evernote, facilitate intrapersonal conversations. NNS interviewees explicitly identified a few affordances of these online platforms that benefited their communication. For instance, the revisablity of online information enables NNS to preview and edit English messages before sharing them with other teammates; the reviewability of both IM conversations and digital notes allows NNS to revisit and translate certain messages into another language for later communication purposes. These findings echo Clark and Brennan's (1991) arguments regarding how the costs of grounding change when communication is mediated by various technologies. Furthermore, my field data indicated that technologies may also shape the way people calculate the social costs of their language use. In the context of IM conversations, for example, private IM channels offered NNS a space to communicate using their native language with a selected audience. Since these conversations were invisible to the rest of the team, people were less concerned about issues related to social inclusion/exclusion as they were during face-to-face communication.

When NNS team members had to use English to communicate, they took advantage of computer-based technologies to retrieve information that consolidated the foundation of their common ground. My observation data suggested that members of multilingual teams often relied on digital information sources, such as Google Image Search, to generate visual representations of absent physical objects. Consistent with previous research on shared visual space (e.g., Fussell et al., 2003; 2004; Gergle et al., 2006; Kraut et al., 2002), my data showed that having visual information lowered the communication barriers NNS encountered during English conversations.

In addition, my study found that online group platforms and social networking sites provided tacit yet important support for multilingual communication. In mosaic teams, NNS reported that they relied on information learned from others' online profiles and posts to infer their expertise and interests. This information served as an implicit role indicator that helped people choose the right language and include proper participants in informal conversations. In both mosaic teams and palette teams, people took advantage of information shared via online platforms to assess community co-membership with their teammates. This co-membership helped them identify common knowledge that was not salient in work-centered activities.

Design Implications for Future Collaboration Technologies

In addition to showing the role technology plays in current multilingual teamwork, my findings also point out some opportunities for designing future communication tools. First, NNS's language use in informal communication was closely associated with their perception of who was participating in a conversation. NS who are perceived as overhearers may want to join in but they cannot do so if the conversation is conducted in an unknown language. New technologies could help people sense the environment and prompt them with information about the context of conversation. More specifically, a system could help speakers stay aware of the

potential participants and what roles each participant has over the course of a conversation. Systems might also increase speakers' awareness of their teammates' views about the use of a common language vs. native languages in particular settings.

Moreover, NS interviewees reported that it would be rude to ask others to shift to English. They also did not want to interrupt others if the topic of the conversation was about personal matters. This raises the interesting possibility of using non-human agents to alleviate the social awkwardness associated with language shift. Research in human-robot interaction has demonstrated how interpersonal interactions that are problematic between people can be facilitated by the use of robots and agents (e.g., Bainbridge et al., 2008; Hoffman et al., 2015; Stoll et al., 2016). Following this line of thoughts, I propose implementing non-human agents, such as desktop robots or intelligent avatars on tablets, in teams' physical workspaces to facilitate interactions between speakers of different native languages. When an agent detects conversations in a language that is not understood by overhearers, it could ask the speaker whether s/he would like to explain the topic of the conversation using the common language. In this way, the speaker could be reminded to reflect on their language choice based on the current context. Overhearers would benefit from this reflection without needing to interrupt others.

Further, the current research found that NNS set up work-related communications on multiple online platforms, including work-focused IM platforms (e.g., Slack), personal IM platforms (e.g., WhatsApp), and digital notes (e.g., Evernote). The languages they used on different platforms were often different, requiring extra effort to integrate and translate all the information surrounding a single work task. Previous CSCW work has shown how text annotation tools can help NNS better process and structure information in English IM conversations (Li & Rosson, 2012a; 2012b). Similar tools might be implemented to support

information management by NNS or even the whole team. For example, annotation tools could automatically generate English tags based on the text exchanged in IM chat. Once key words, such as a particular technical term, are detected, the annotation tool could mark this part of the conversation and categorize it as a note. It might also generate auto-reminders to NNS to ask if they would like to move the conversation to a work-focused platform or summarize the conversation in English. When NNS need to integrate information across IM platforms and languages, they could use the automated tags to organize and/or translate these conversations with less effort.

Last but not least, members of the teams I observed often used information disclosed in others' online social profiles and posts to infer their community co-membership. This information offers people hints regarding what words, examples and metaphors they can incorporate into a new message to maximize the audience's understanding. Learning information about others' community co-memberships may also have subtle influences on the social dynamics between team members. Previous MNC studies have pointed out that members of multilingual teams are often divided into subgroups by fault lines that formed along multiple dimensions of asymmetry. Native language is one of those potential dimensions, and it might be activated or de-activated depending on its (mis)alignment with other factors (e.g., Hinds et al., 2014). Thus, there is reason to believe that co-memberships beyond the shared speech community may help people in multilingual teams discover multiple ways to group and regroup themselves. Future online platforms might consider ways to improve interlocutors' awareness of their commonalities along various dimensions. This information would contribute to both grounding efficiency and social integration between team members speaking different languages.

All the design ideas discussed above follow the same design philosophy as it is highlighted by my current research. Specifically, language use in multilingual teams is sensitive to norms and concerns attached to each communication context. This contextual aspect of language use is revealed in the way people use technologies to facilitate their current communication and it should also be considered when designing future communication tools for multilingual teams.

Limitations and Future Directions

There were several limitations to the current study. First, my study was conducted with teams at a specific university in the United States. Findings regarding people's contextual use of language were therefore qualified by certain attributes of those teams, including the fact they were collocated, research-oriented, and non-industrial. In addition, they required high English language competence. Future research will be needed to verify to what extent the current findings can be transferred to other forms of multilingual teams.

Further, I collected my field data by going to the workspace of each team and observing their communication events in person. My physical presence might have had a subtle influence on people's language use, although I conducted preliminary observations before the formal observation period to try to minimize this influence. Future research should apply other methods, such as experience sampling, to allow people to describe their real-time experiences without interacting directly with the researcher (Hektner et al., 2007). Concepts and associations identified by the current study provide a useful framework for designing these future studies.

Finally, due to requirements of my volunteer teams, I was not able to obtain audio and/or video recordings of observed communication events. My hand-written observation notes, despite being quite detailed, would not allow me to conduct a systematic analysis of people's actual

language use at the conversational level. I was not able to look at, for example, how exactly situational factors were associated with not only the type of language people used but also the detailed linguistic features of their utterances. Future research may consider using lab experiments to collect more micro-level data, so that it is possible to gain a deeper understanding of language use in multilingual teams by applying conversational analysis.

CHAPTER 6

CONCLUSION

This dissertation presented an in-depth field study that aimed at better understanding work communication in teams consisting speakers of multiple native languages. The two general research questions that guided this research were: 1) *when* and *why* members of multilingual teams used English rather than their native language, and vice versa, at work; and, 2) *how* they incorporated various strategies, if any, into the use of English or their native language such that they could maximize the values and minimize the costs of their language choice.

I collected observation and interview data with six teams from the same research-oriented university in the United States. Half of these teams were mosaic teams that included subsets of NNS members speaking the same native language; the rest were palette teams in which each NNS member spoke a different native language from other NNS. Data analysis suggested that NNS in multilingual teams often shifted back and forth between using English and their native language based on their situational needs. They developed context-based strategies, such as using certain discourse markers and exploring affordances of communication tools, to balance the positive and negative consequences of their moment-to-moment language choices. When team members had to use English as a common language, they relied on three types of co-presence to resolve grounding problems. They also took advantage of materials, human resources and technologies embedded in the contextual environment to ensure their co-presence. The language use practice of individual members affected how information sharing and interpersonal dynamics were structured at the team level. People speaking different native languages worked collaboratively to fulfill the team's potential of incorporating information across language boundaries.

Findings of this research contributed to previous literature by portraying the dynamics of language use and its effects on multilingual teamwork in a field setting. They also inspire the design of future computer-based tools that could facilitate daily communication in multilingual teams.

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